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Publication Title:

Electronic video lottery system

Abstract:

Abstract of GB2148135

The system includes a central computer system (10), a plurality of lottery agent terminals (44) in direct dial-up communication with the computer system over the telephone line, and a plurality of lottery game terminals (45a-45h) associated with each lottery agent terminal (44) and coupled in parallel for serial communication with said lottery agent terminals. The central computer system consists of three minicomputers (16, 20, 24) intercoupled on a common network. Each minicomputer includes a data memory storage disc and display keyboard. A first of said minicomputers (16) provides a primary central processor for maintaining a lottery system data base. The lottery agent terminal (44) is connected for encrypted communication with the central computer (10) and provides statistical data from lottery game terminals, communicates high-tier lottery wins and malfunctions (including security breaches), provides a hard copy audit trail of significant events, provides a means of ticket validation and payment record, and provides daily and weekly accounting information on demand as necessary to the central computer and the lottery agent.

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WO 8101664 US 3810627  
US 4033588 US 3786234

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## (54) Electronic video lottery system

(57) The system includes a central computer system (10), a plurality of lottery agent terminals (44) in direct dial-up communication with the computer system over the telephone line, and a plurality of lottery game terminals (45a—45h) associated with each lottery agent terminal (44) and coupled in parallel for serial communication with said lottery agent terminals. The central computer system consists of three minicomputers (16, 20, 24) intercoupled on a common network. Each minicomputer includes a data memory storage disc and display keyboard. A first of said minicomputers (16) provides a primary central processor for maintaining a lottery system data base. The lottery agent terminal (44) is connected for encrypted communication with the central computer (10) and provides statistical data from lottery game terminals, communicates high-tier lottery wins and malfunctions (including security breaches), provides a hard copy audit trail of significant events, provides a means of ticket validation and payment record, and provides daily and weekly accounting information on demand as necessary to the central computer and the lottery agent.

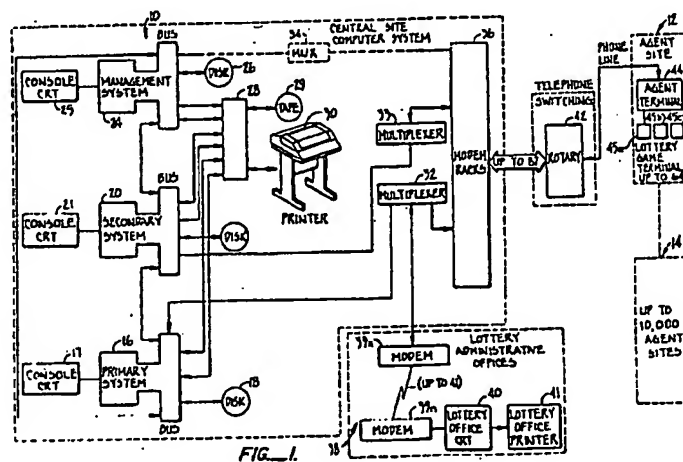


FIG. 1

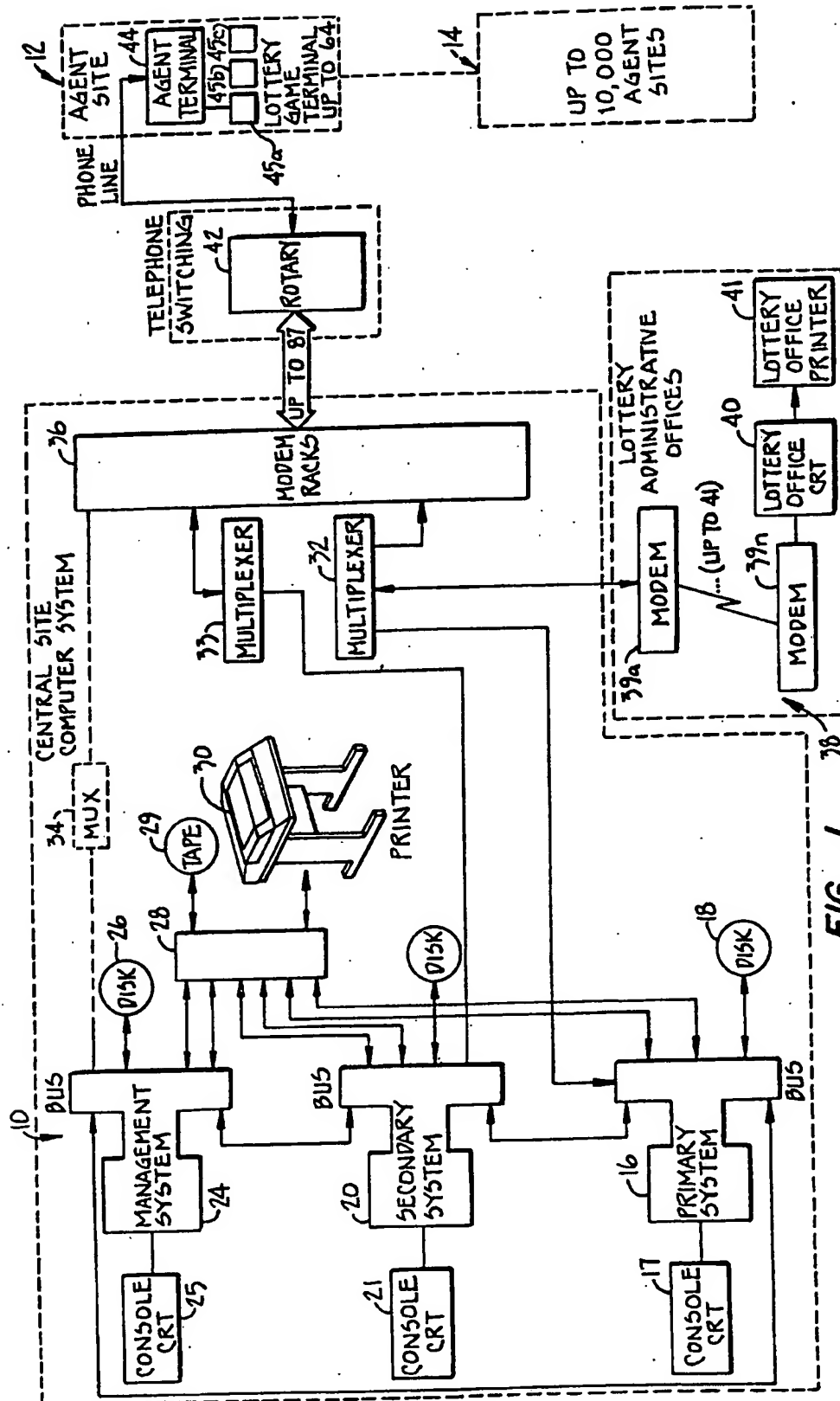


FIG. 1.

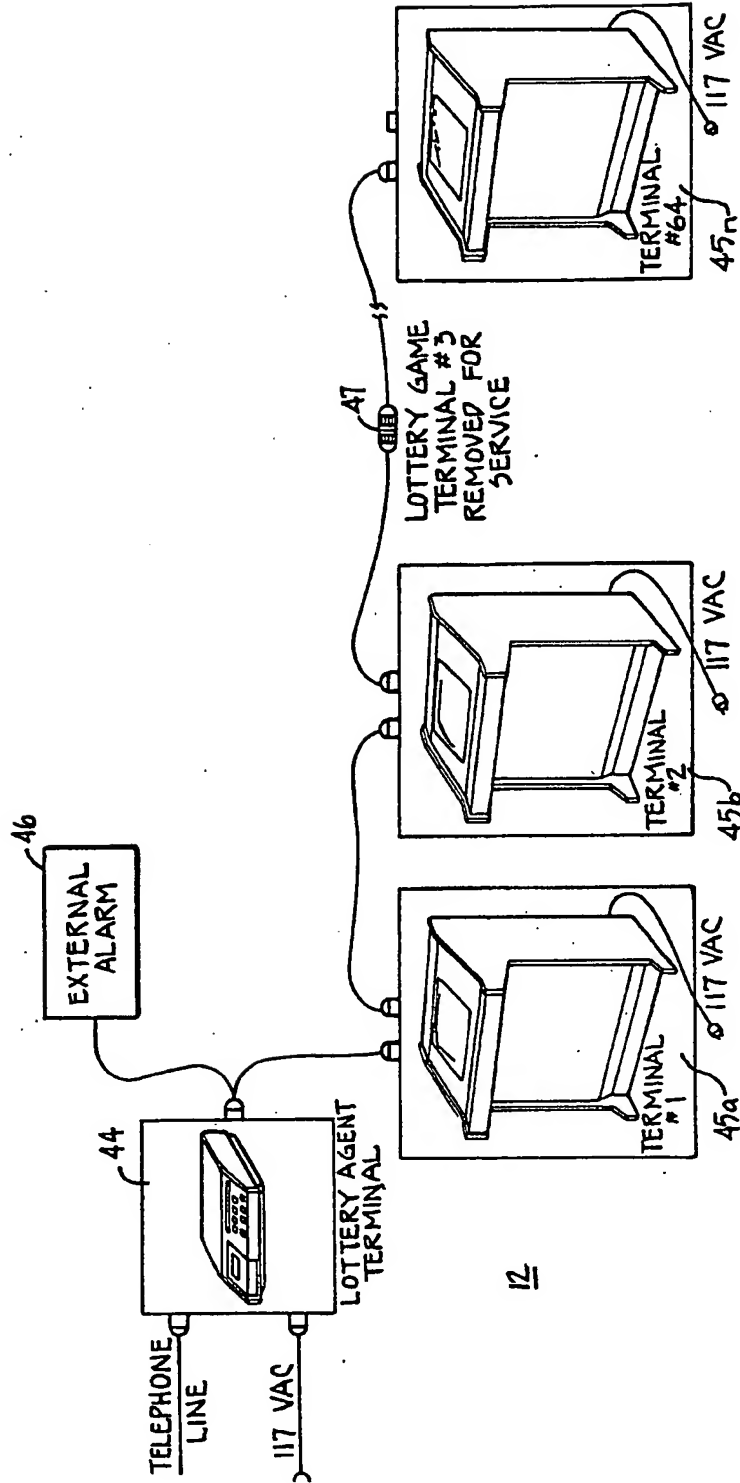


FIG. 2.

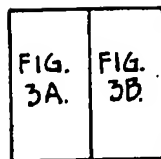


FIG. 3.

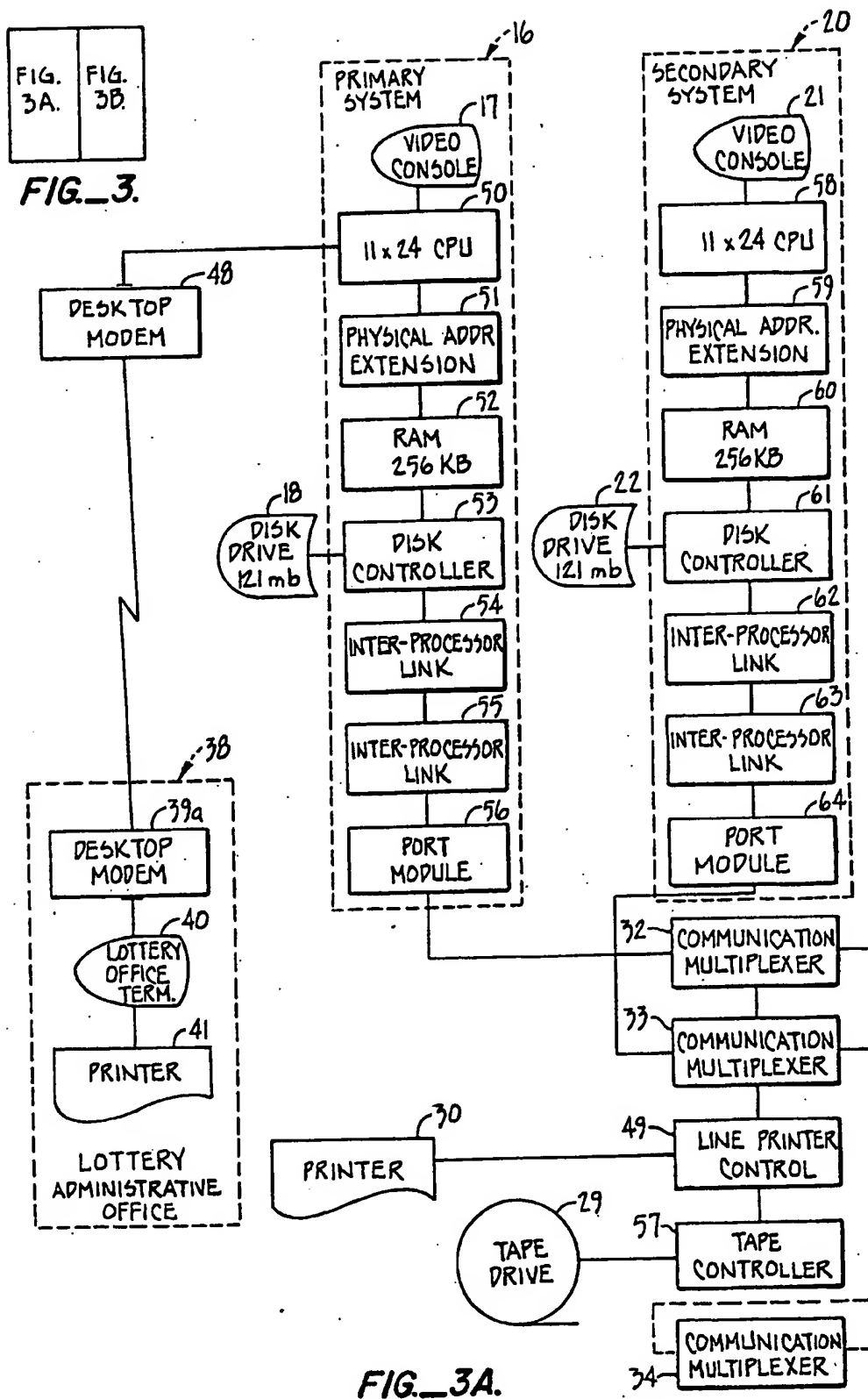


FIG. 3A.

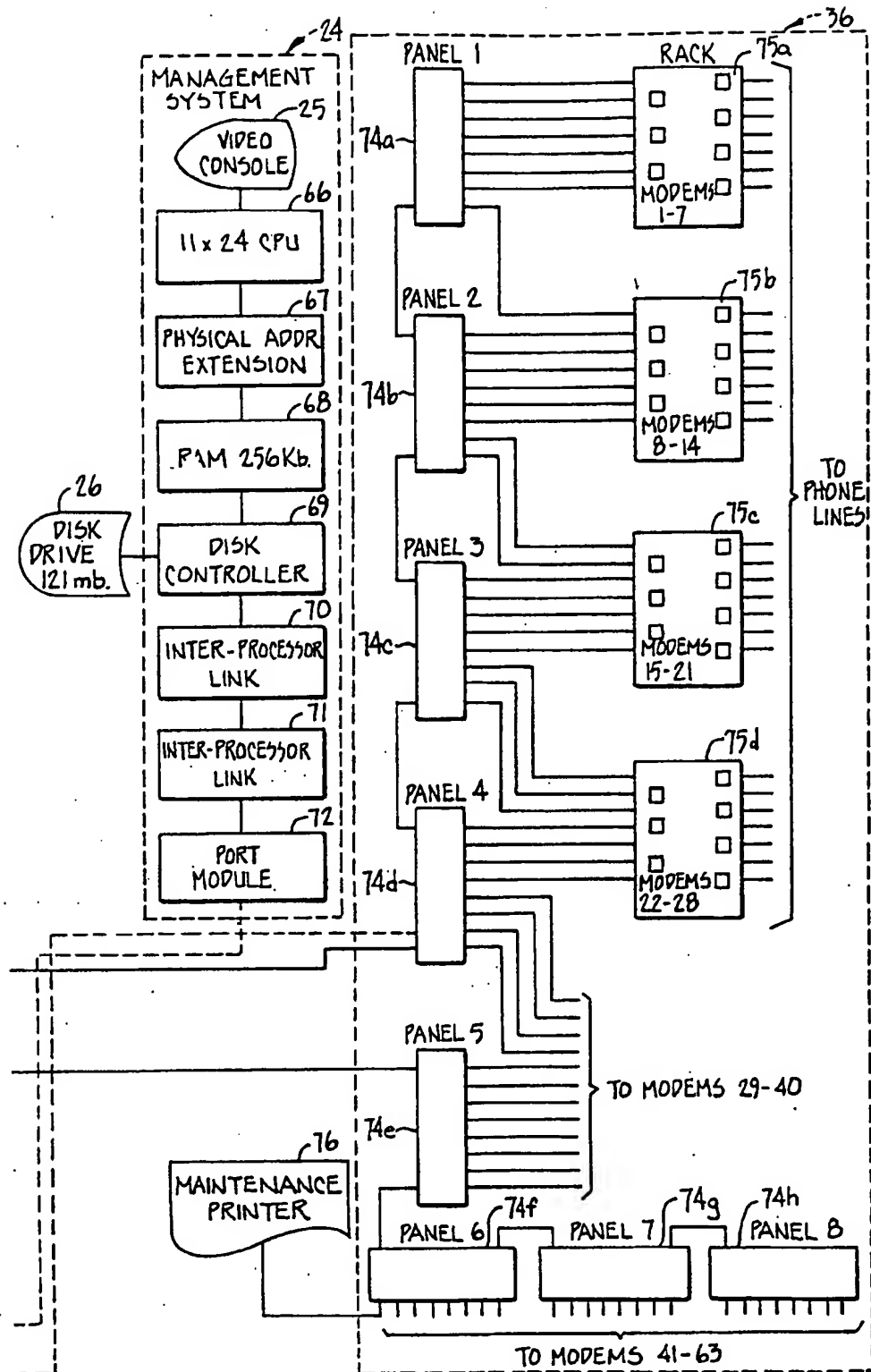
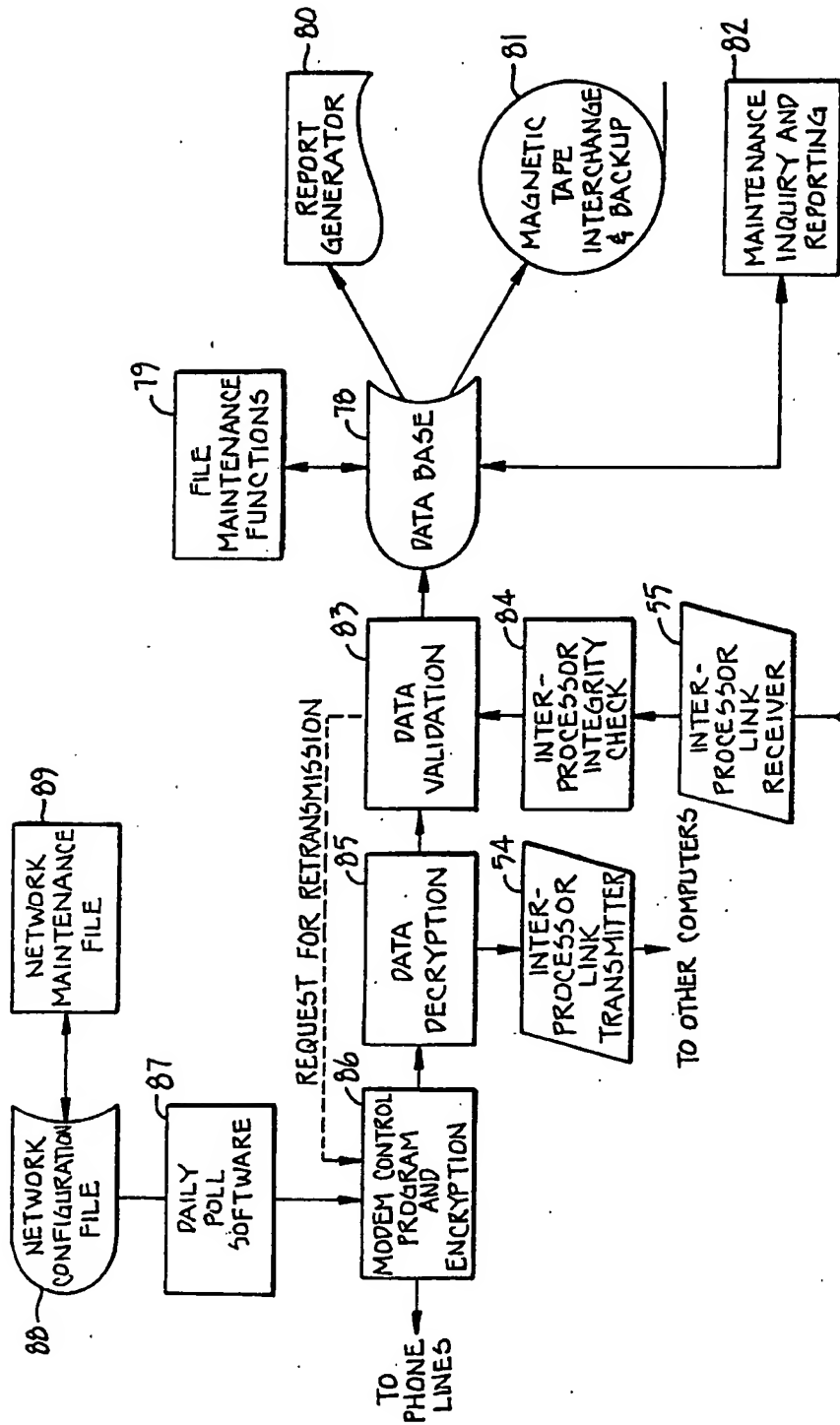
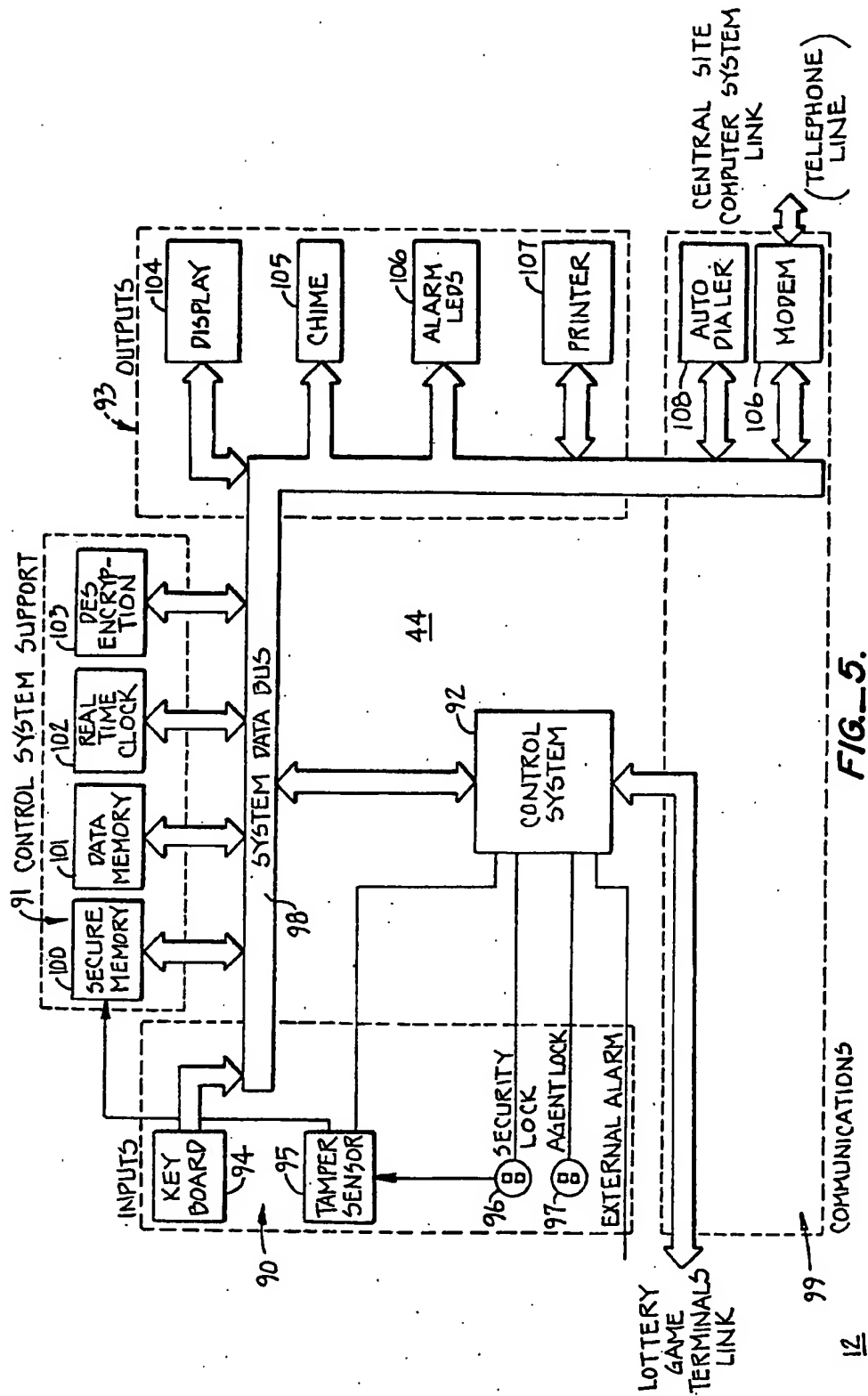


FIG. 3B.



FROM OTHER COMPUTERS

FIG. 4.





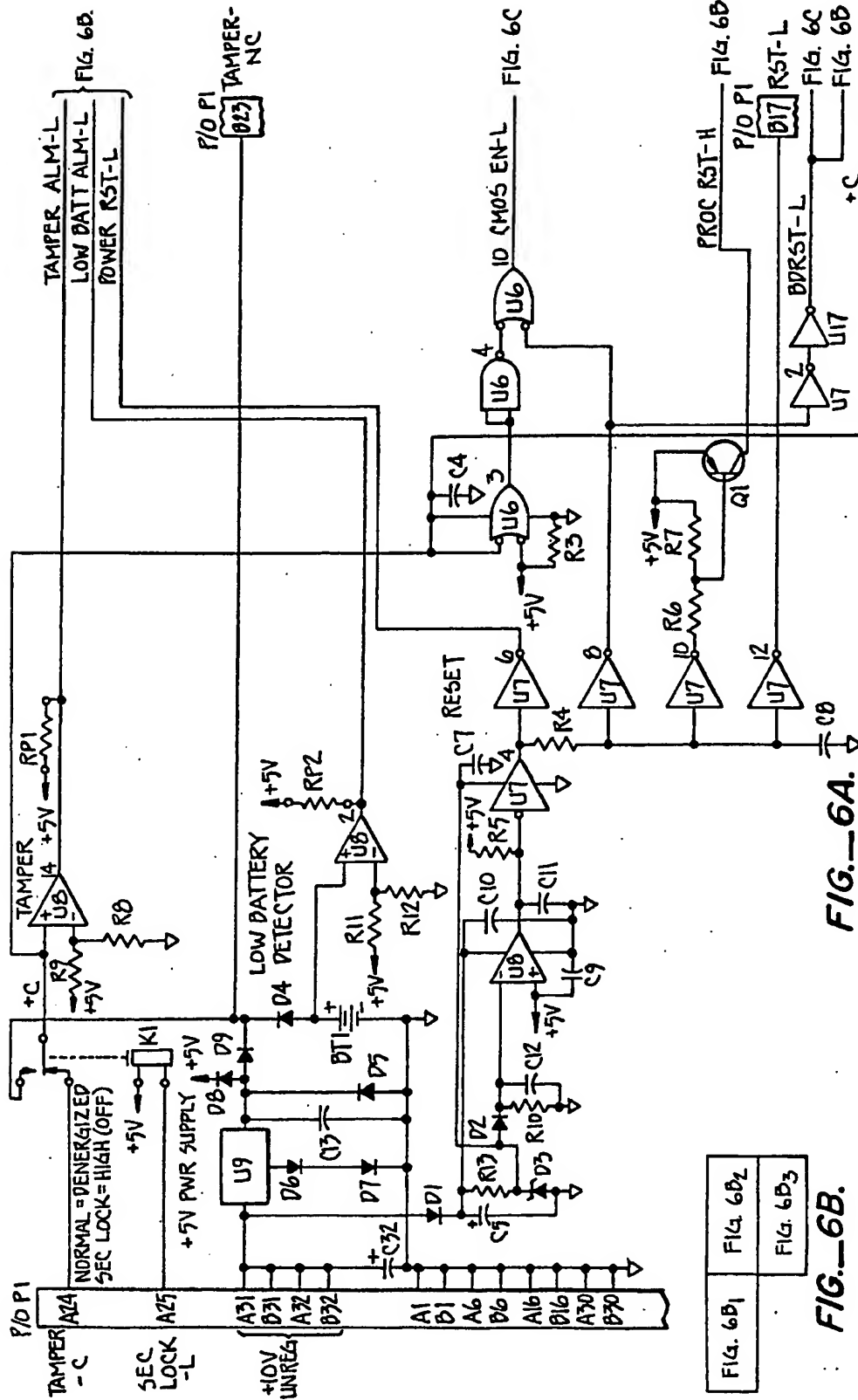


FIG. 6A.

FIG. 6B.

FIG. 6B1	FIG. 6B2
FIG. 6B3	FIG. 6B4

FIG. 6B<sub>1</sub>

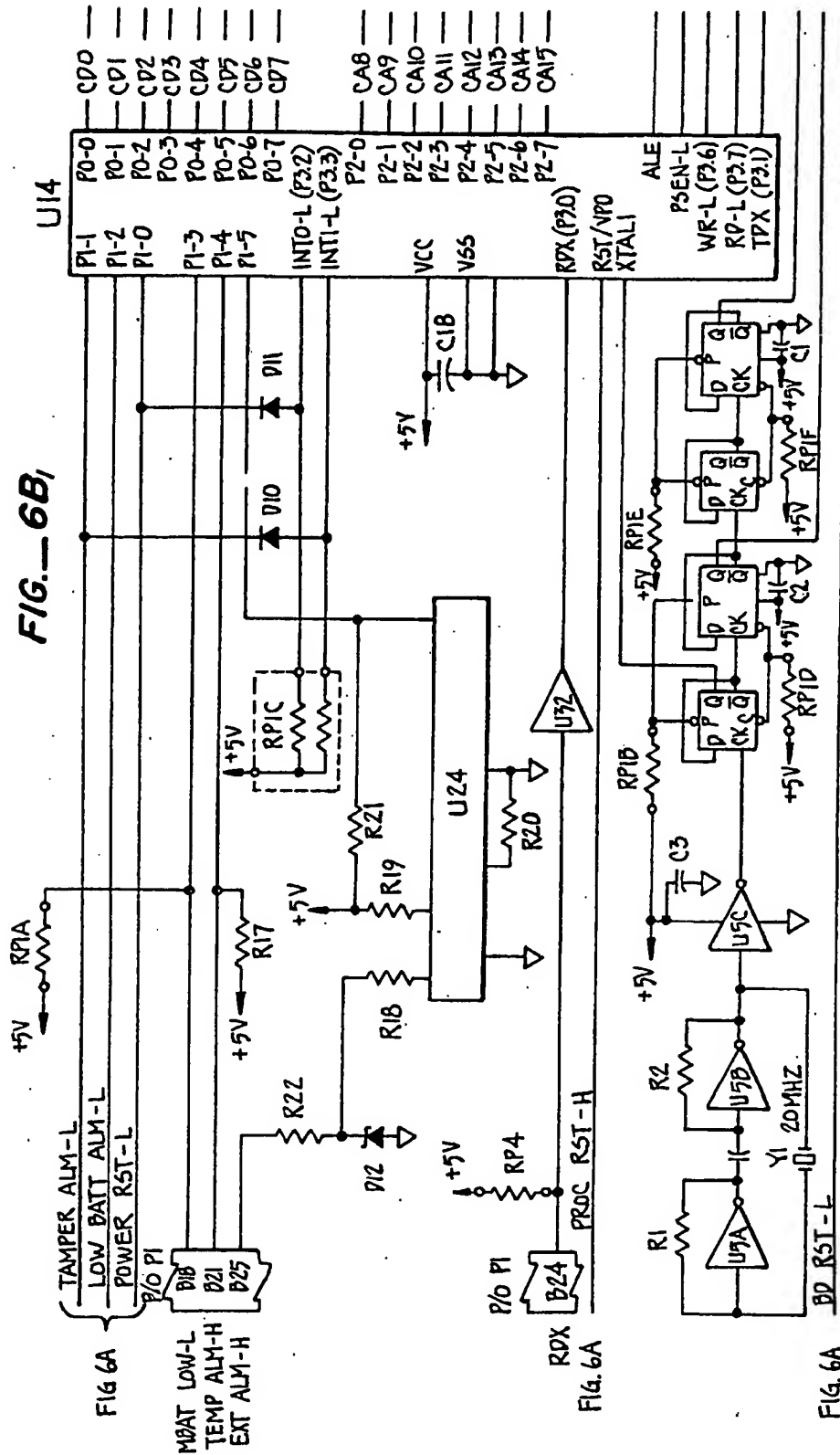
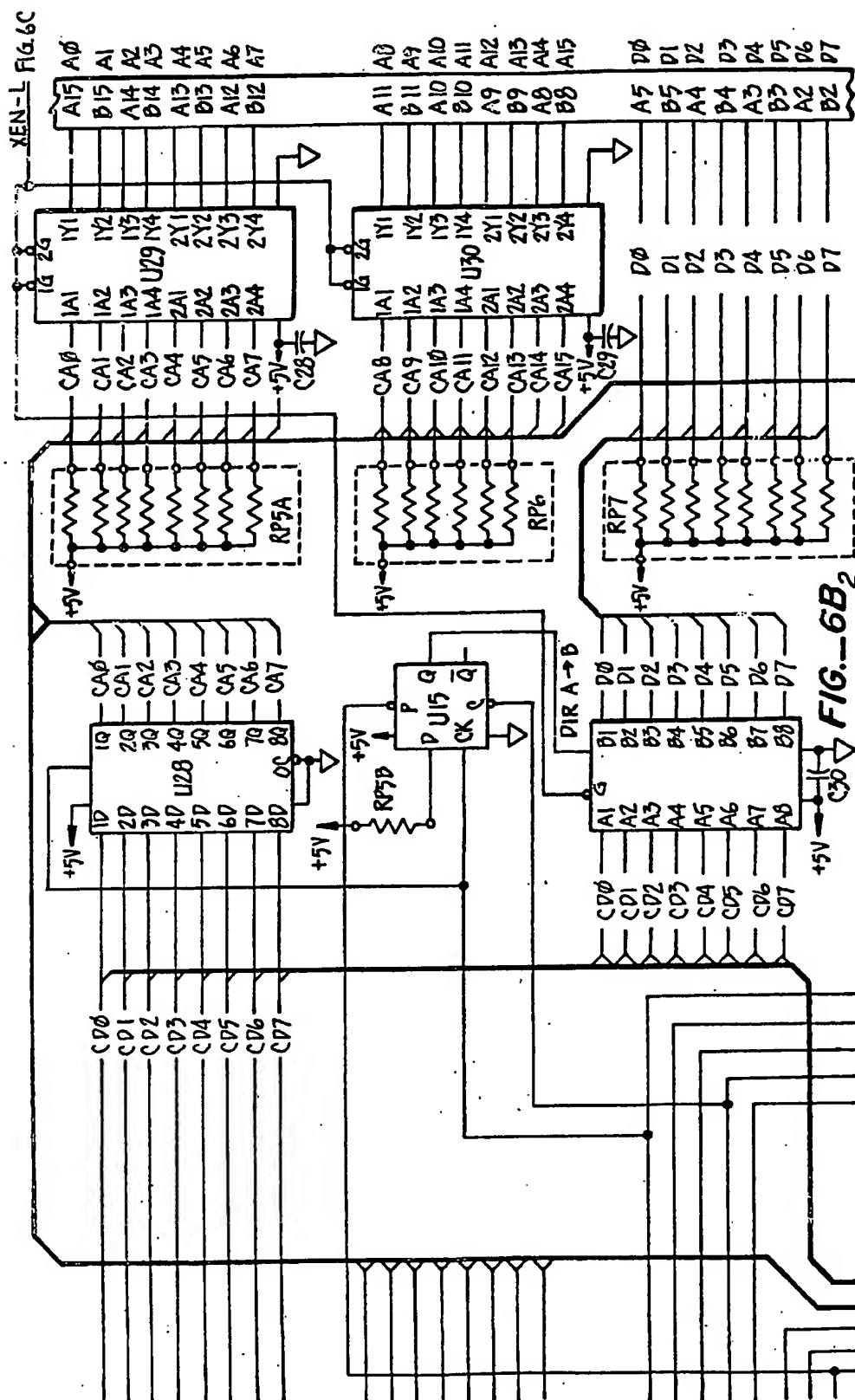


FIG. 6A



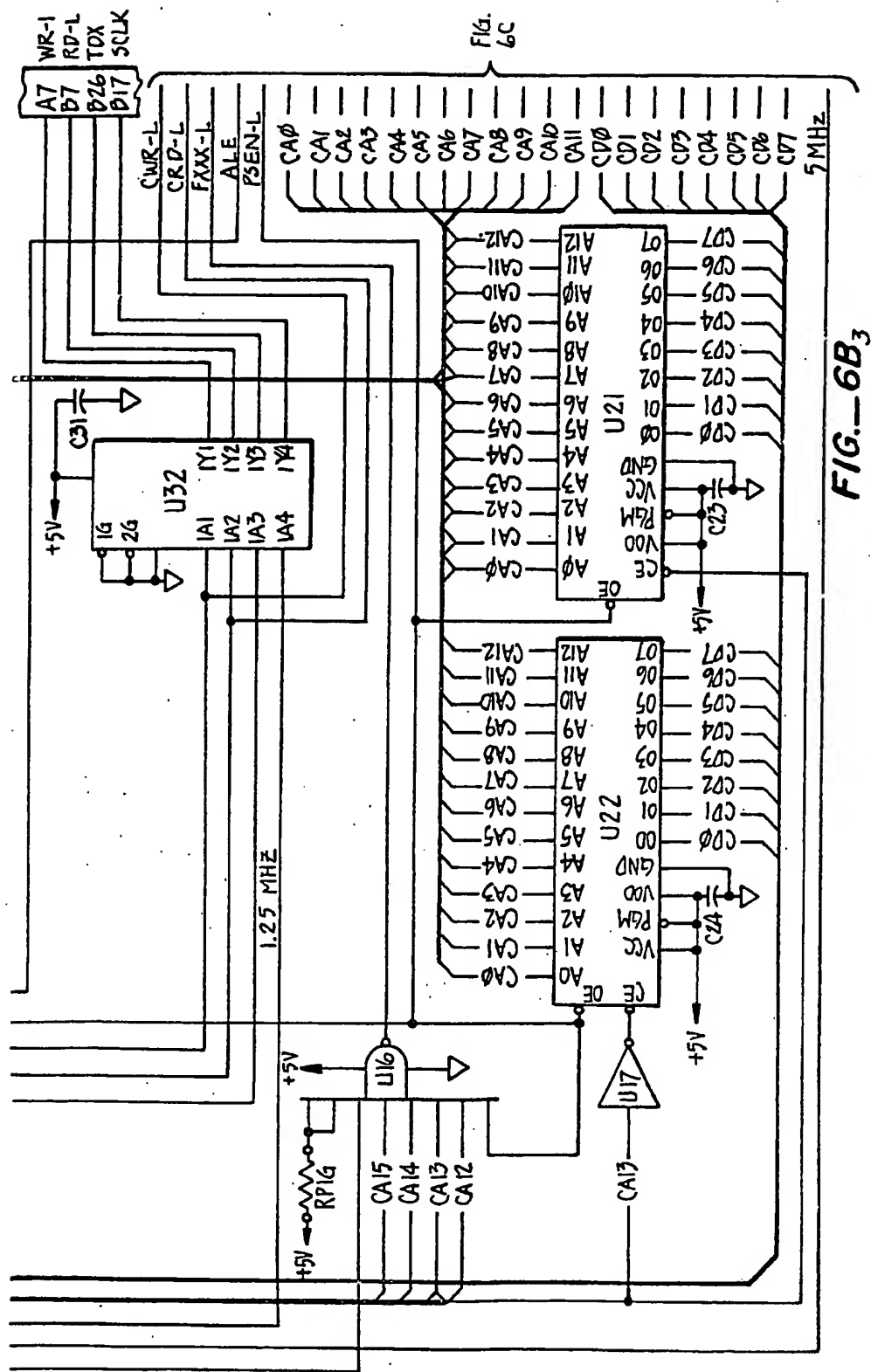
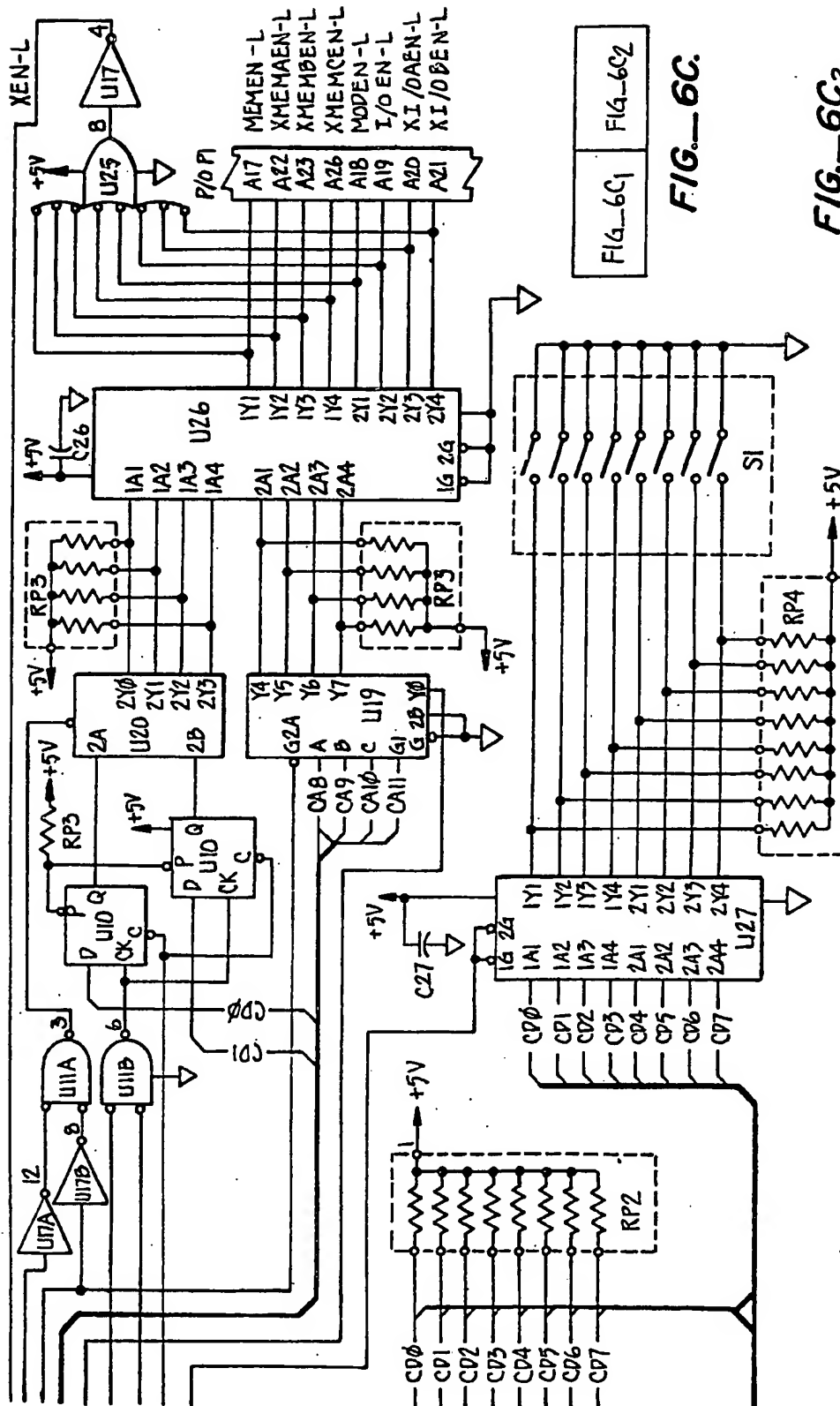


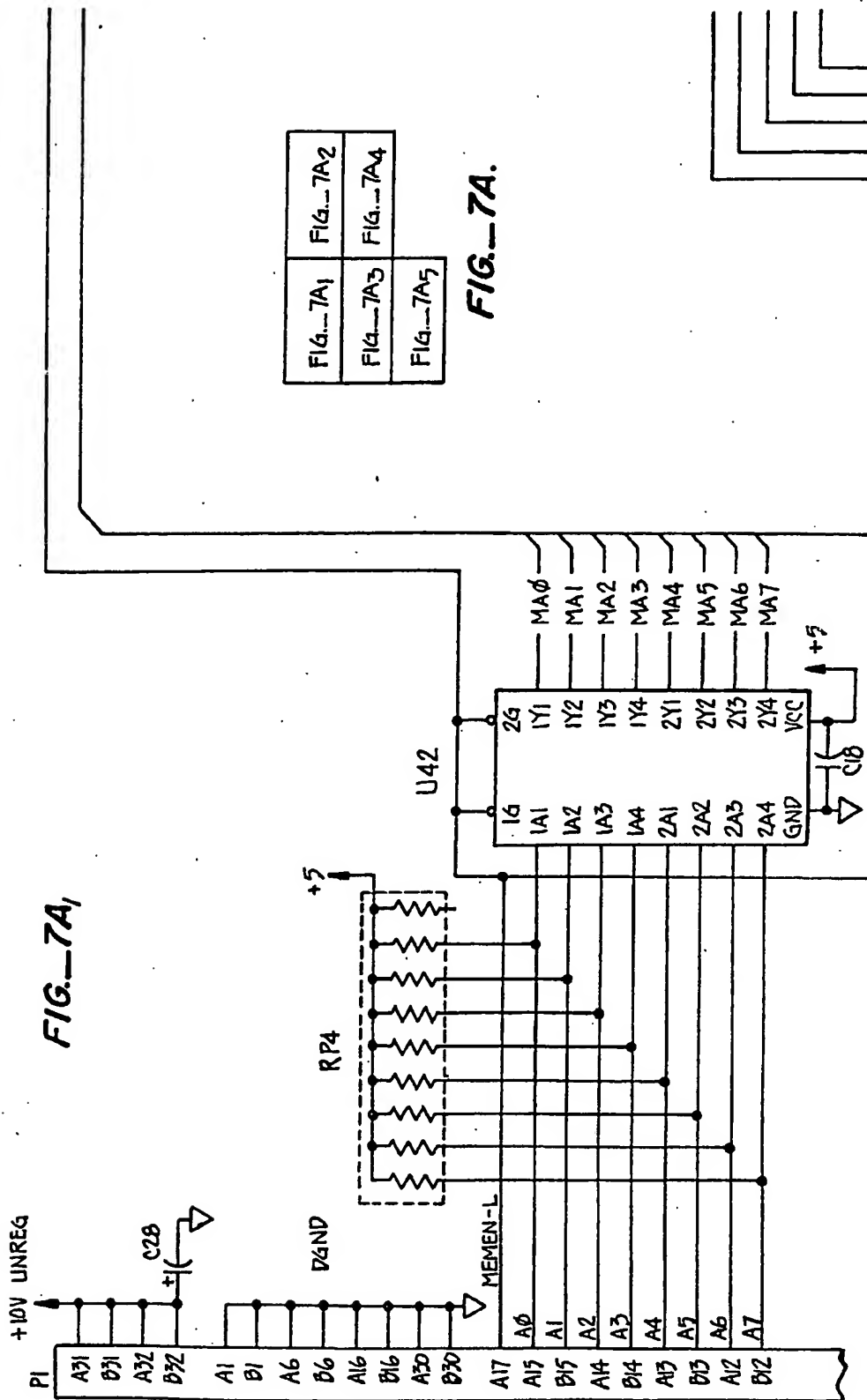
FIG. 6B<sub>3</sub>

FIG. 6C

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MEMEN-L →

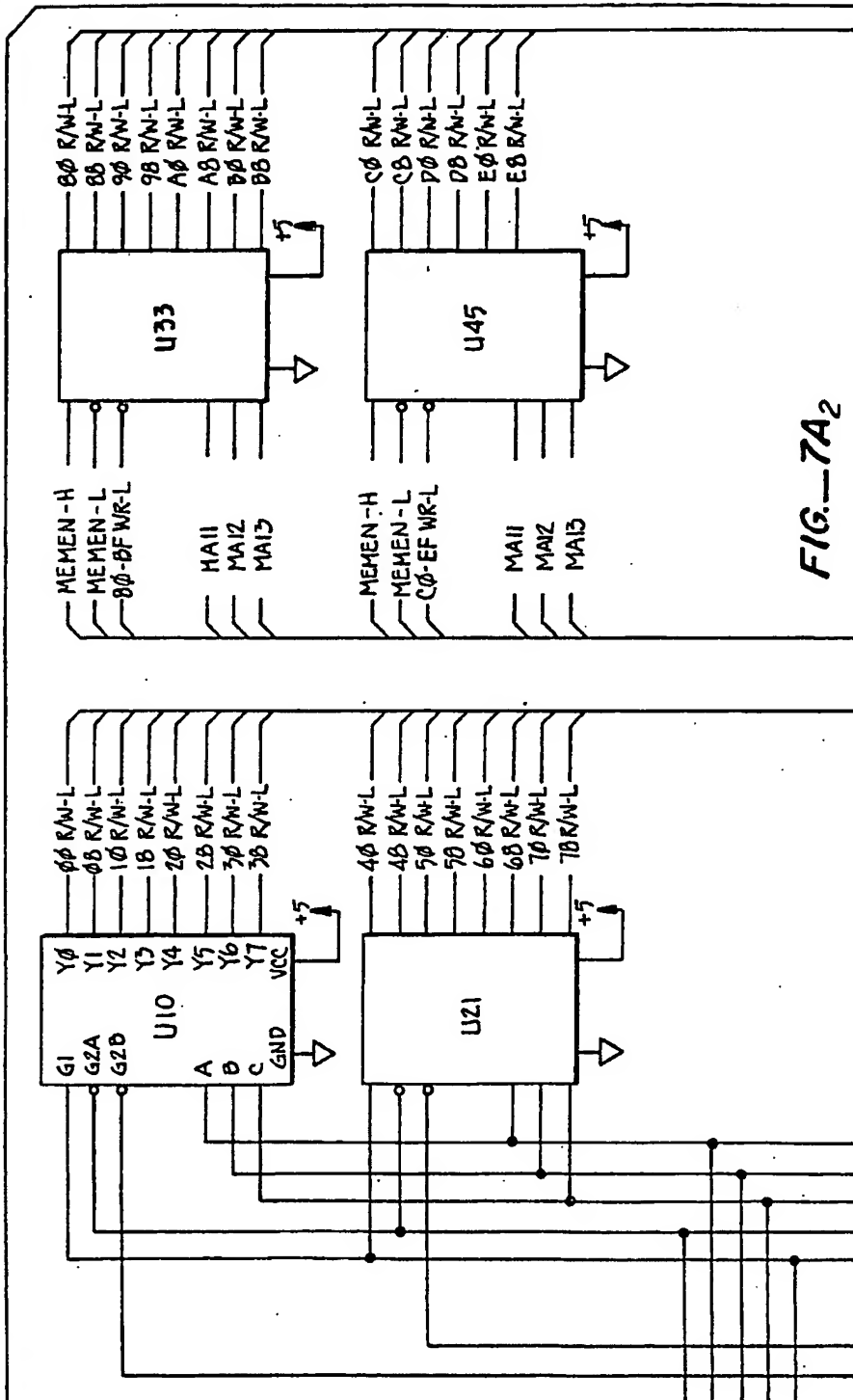
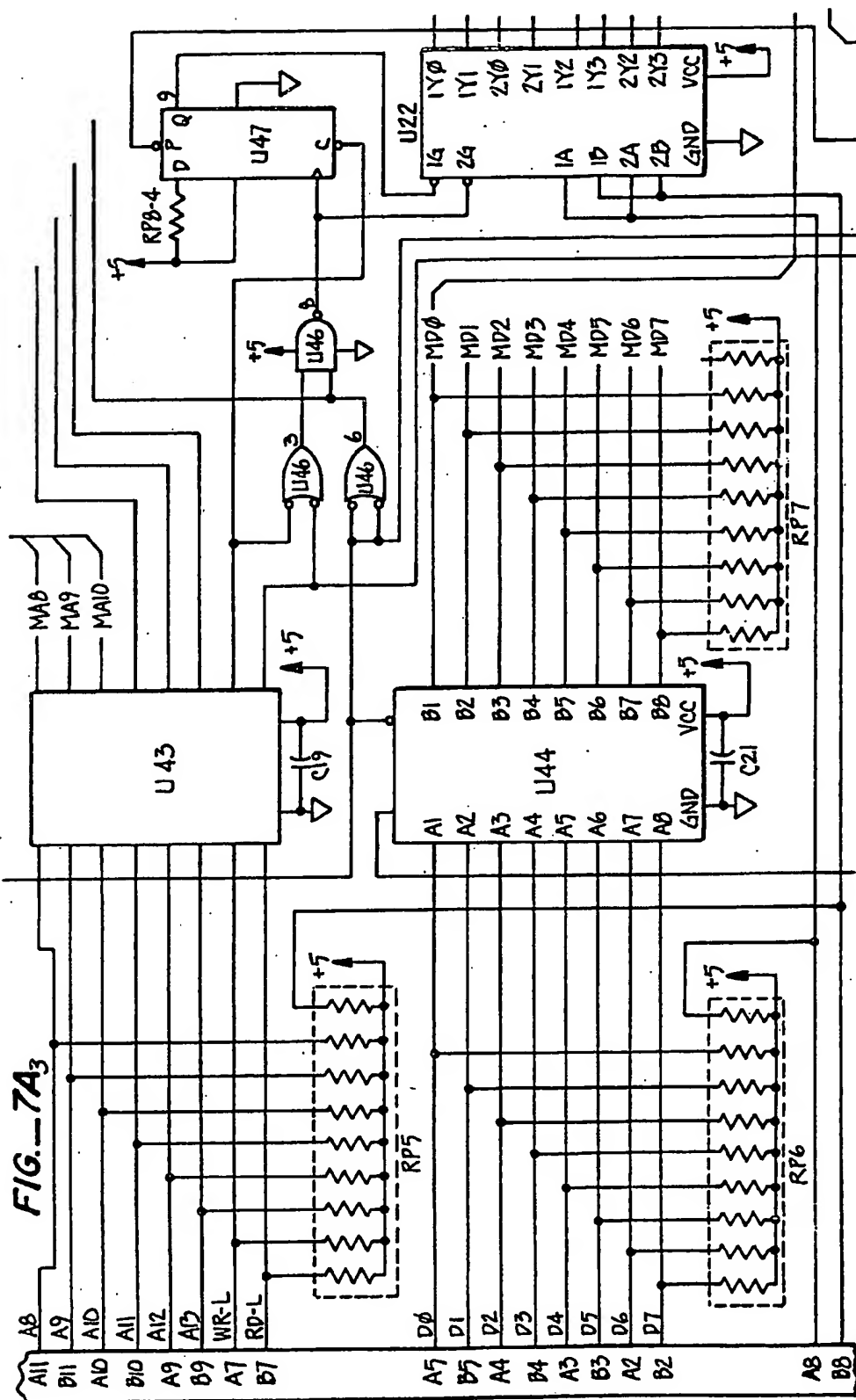
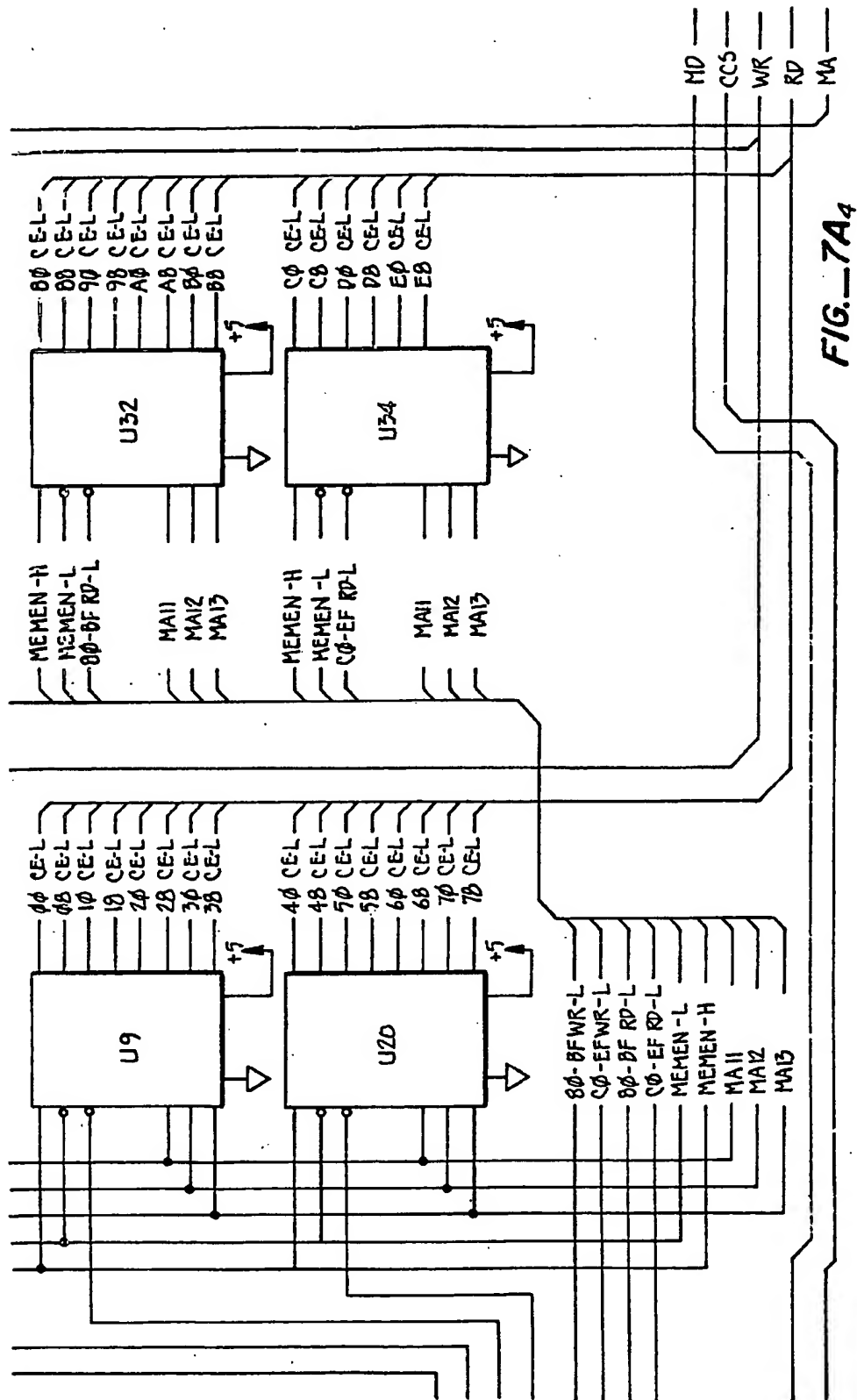


FIG. 7A<sub>2</sub>





FIG. 7A<sub>4</sub>

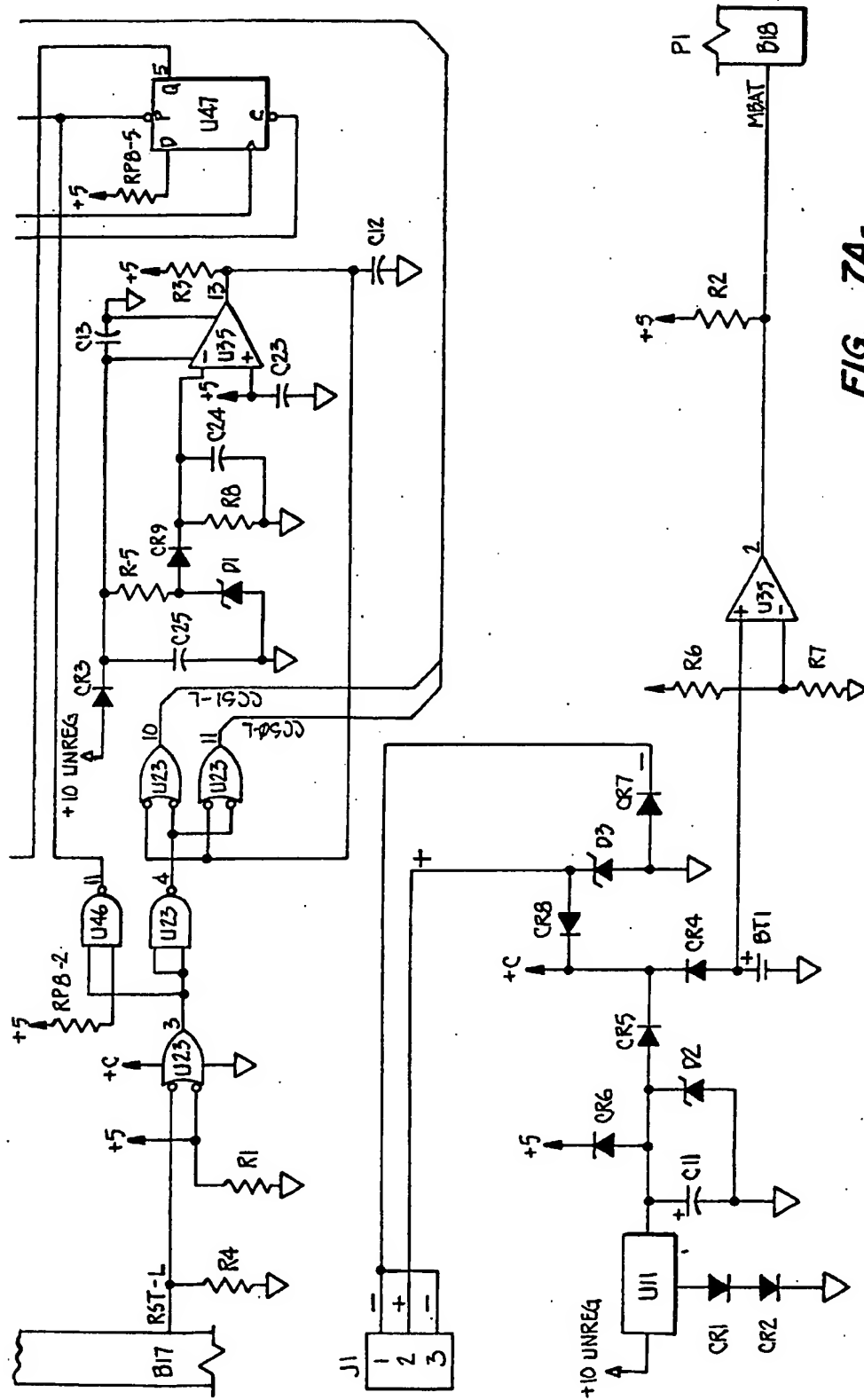


FIG.—7A5

FIG. 7B<sub>1</sub>

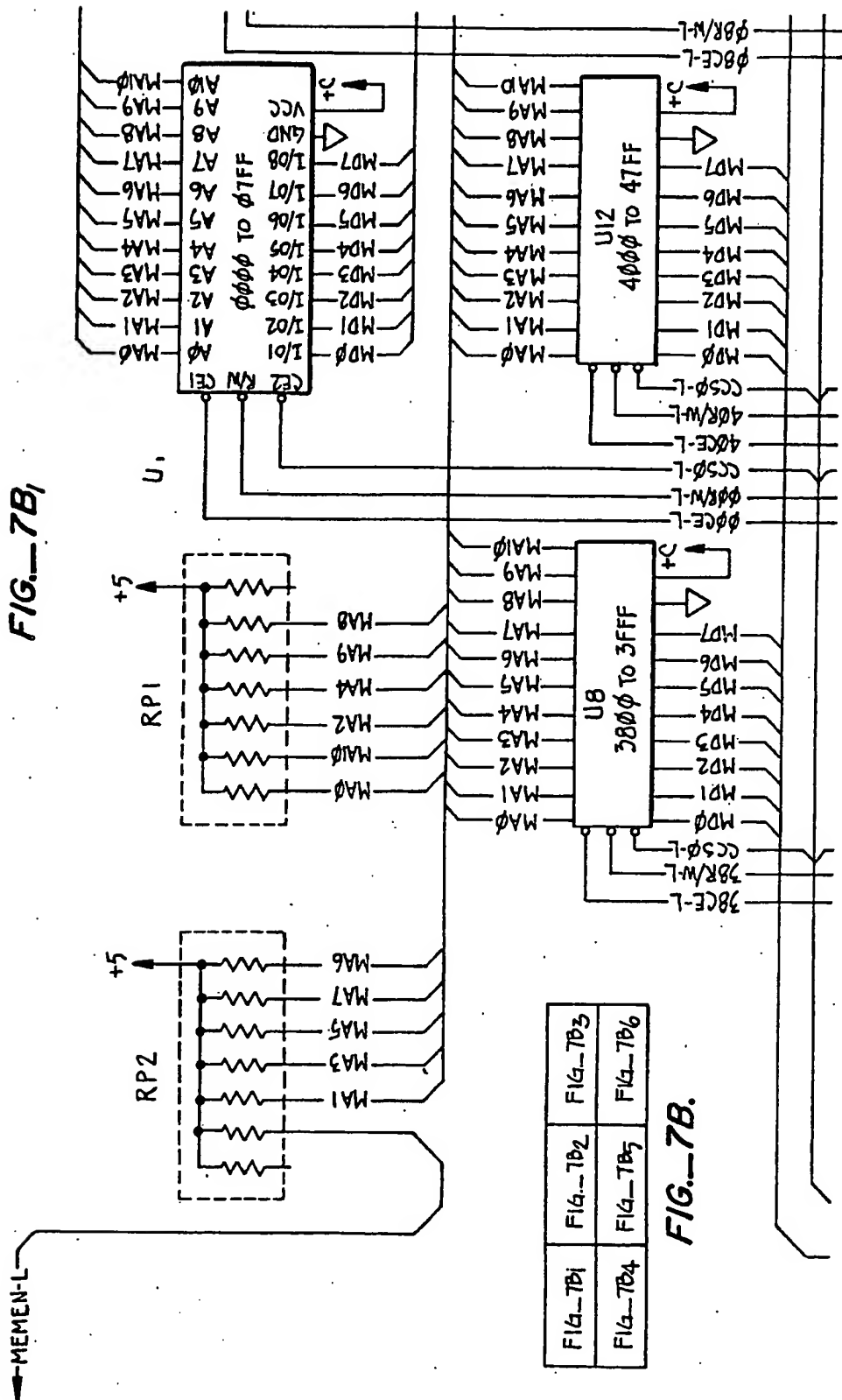


FIG. 7B.

F14-7B1	F14-7B2	F14-7B3
F14-7B4	F14-7B5	F14-7B6

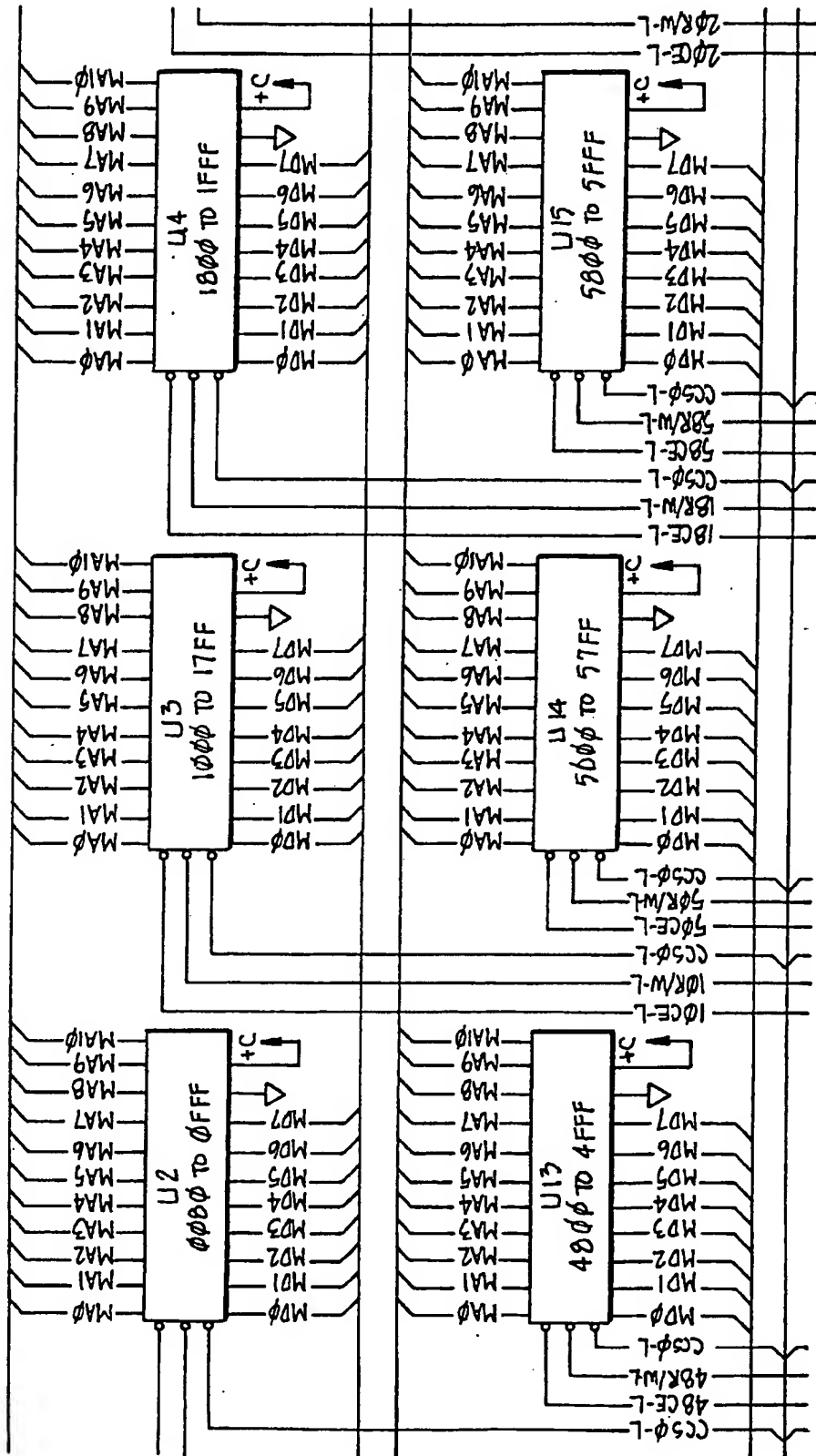
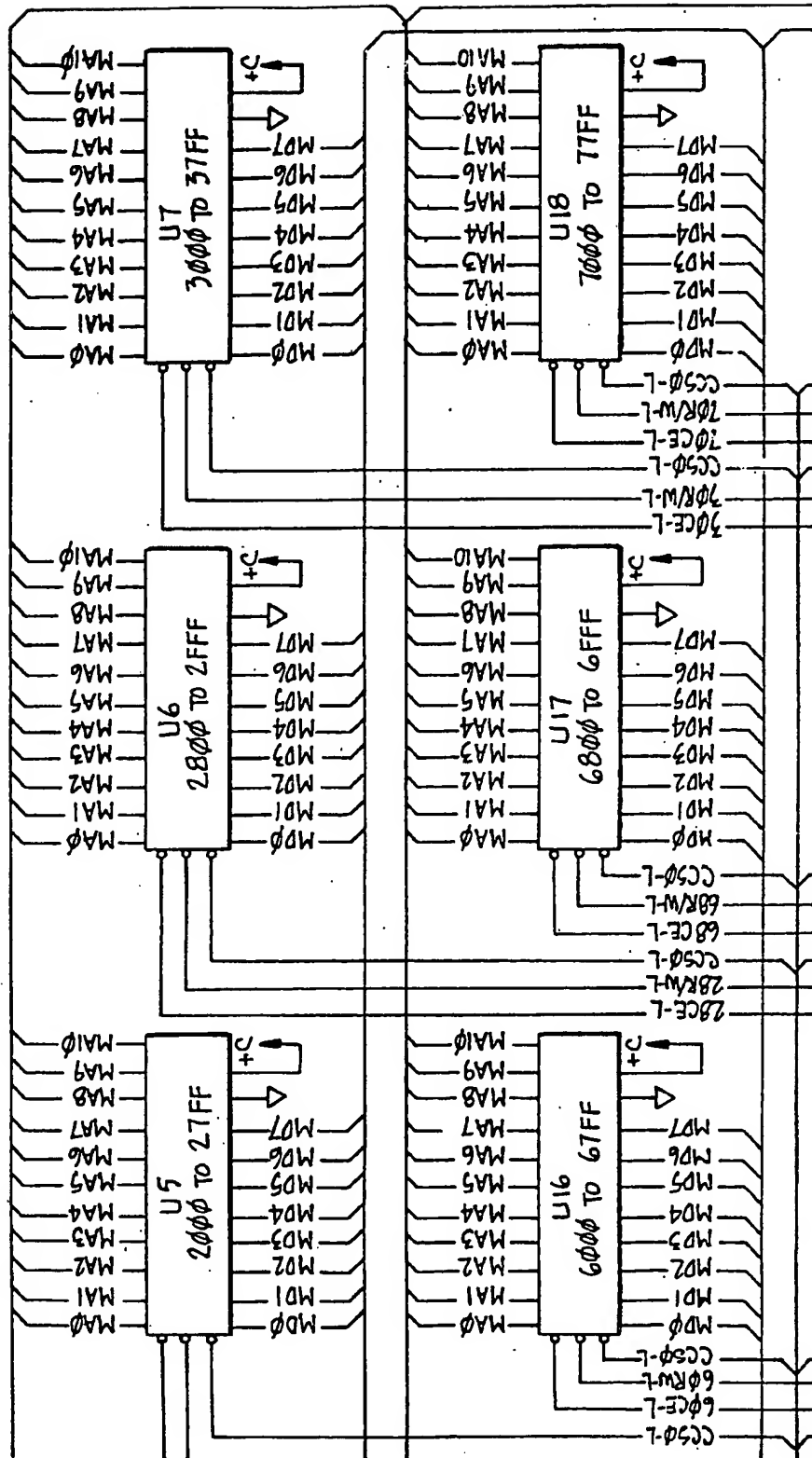
FIG.—7B<sub>2</sub>

FIG. 7B<sub>3</sub>

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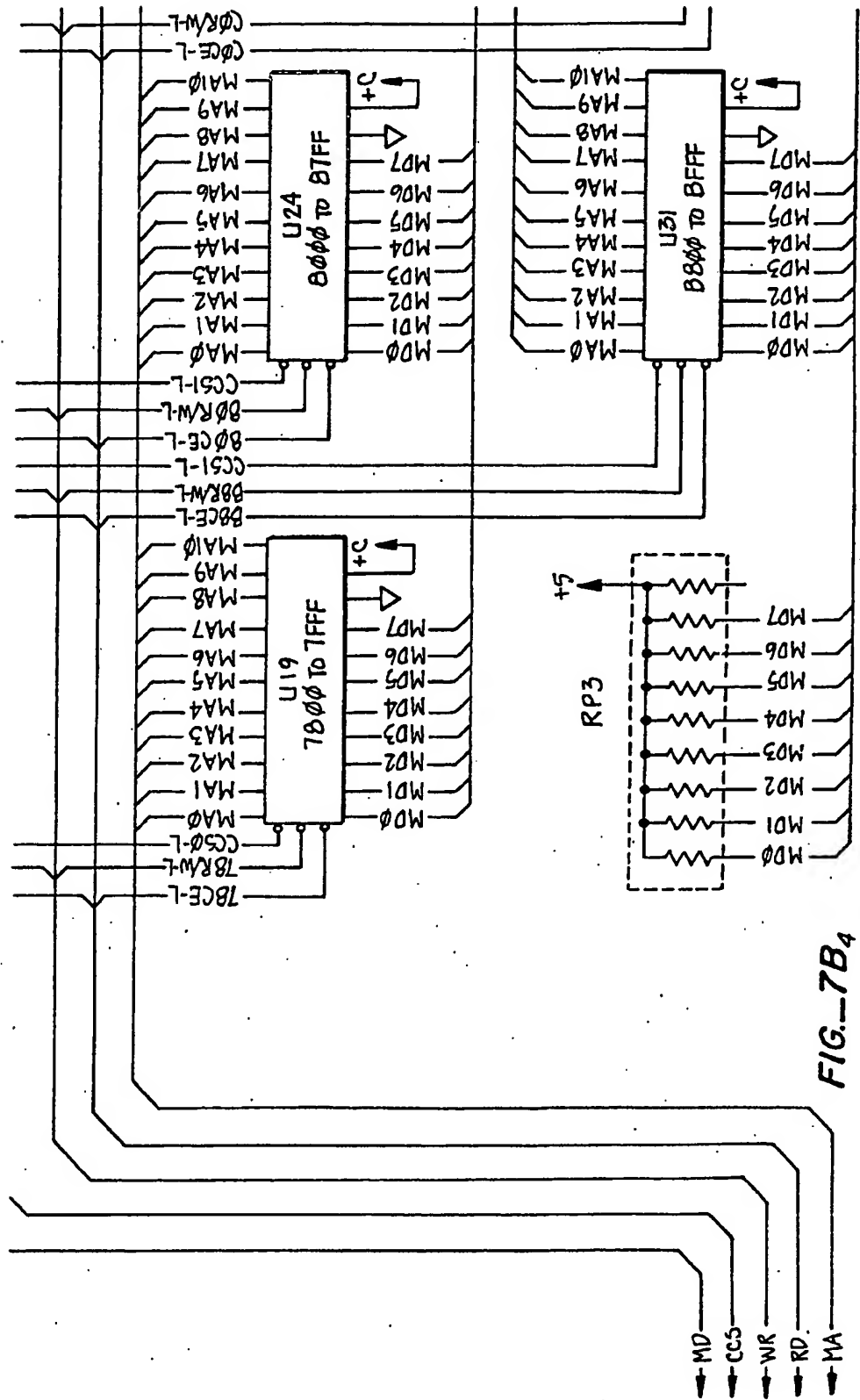
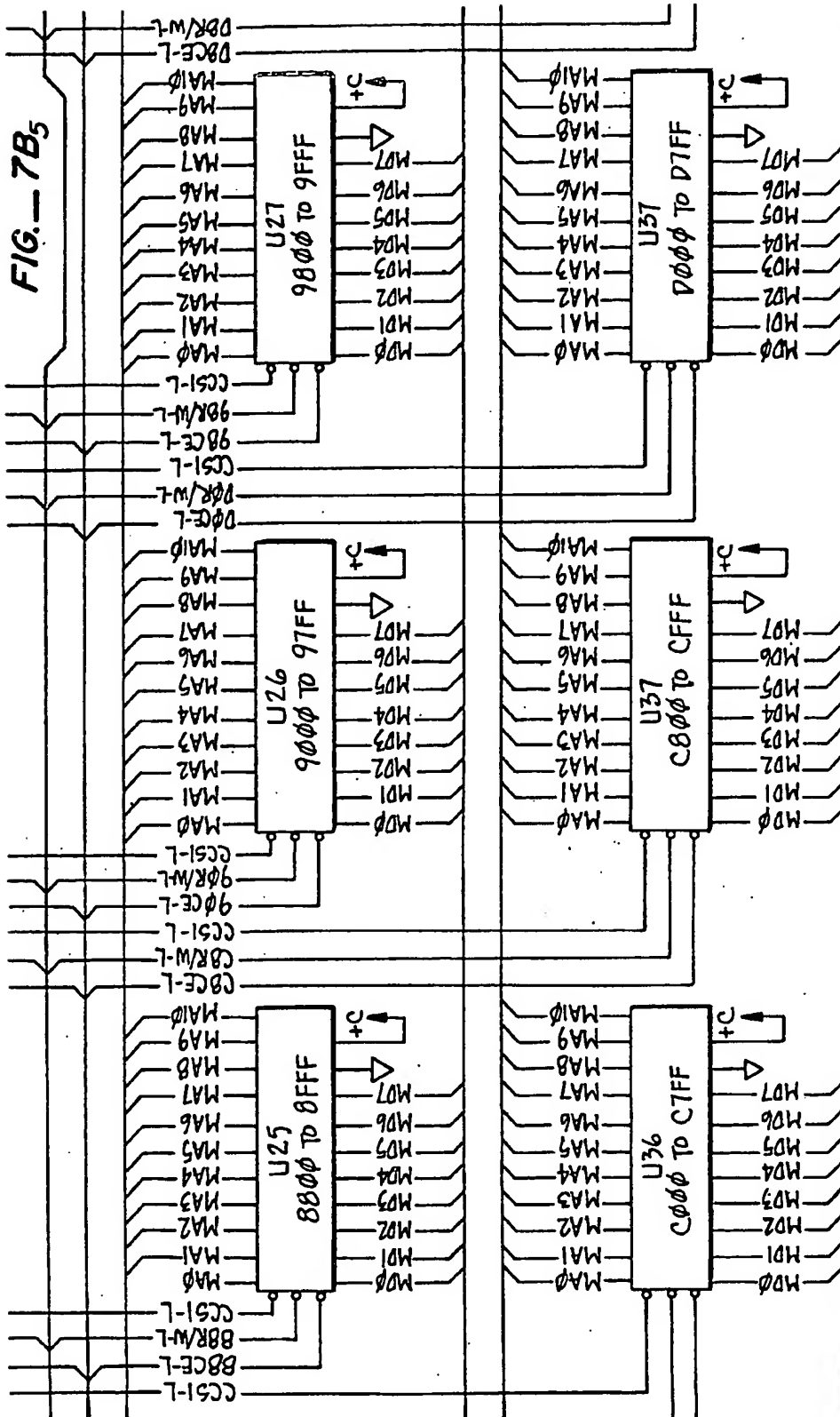


FIG.-7B4

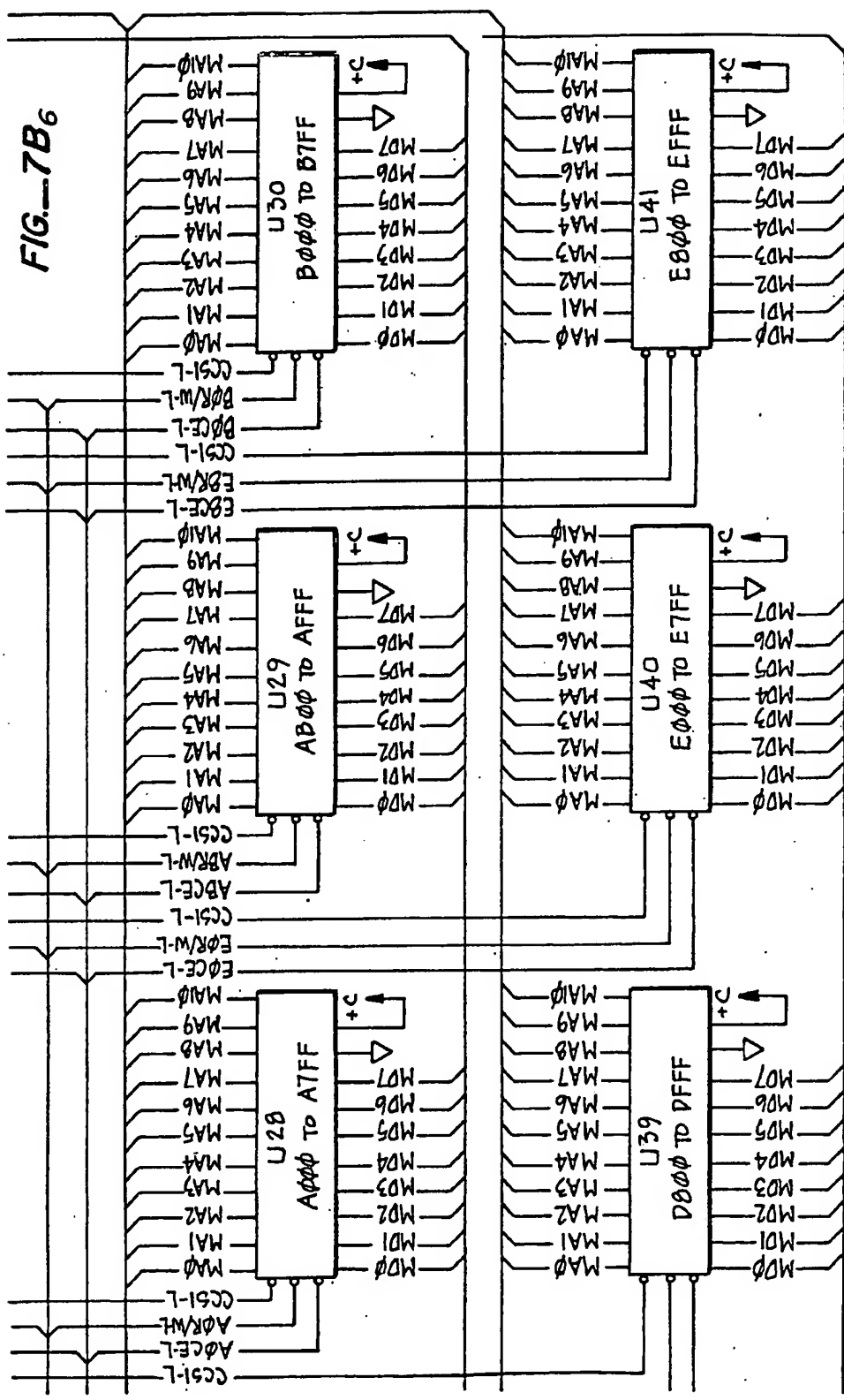
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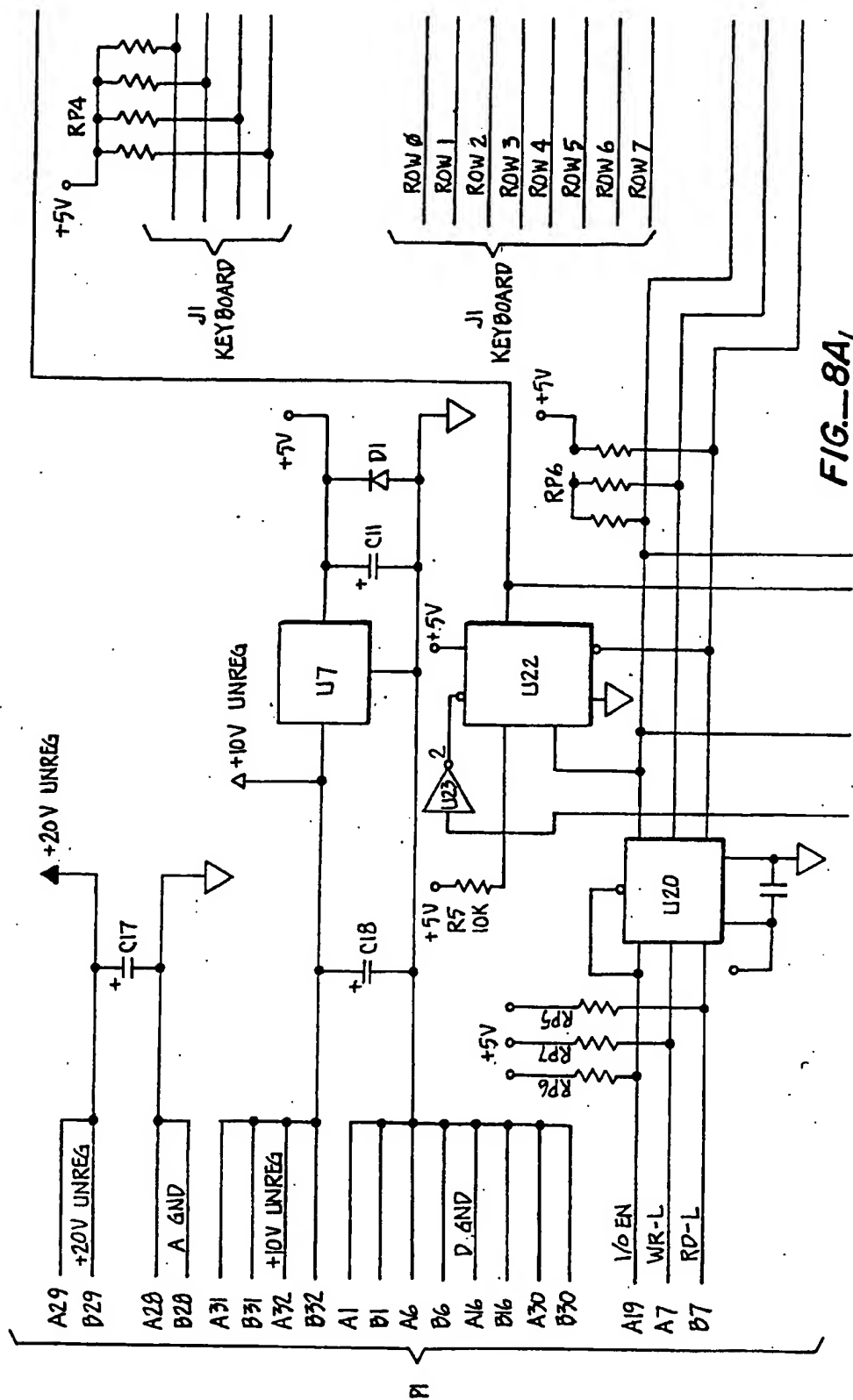


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FIG. 7B6



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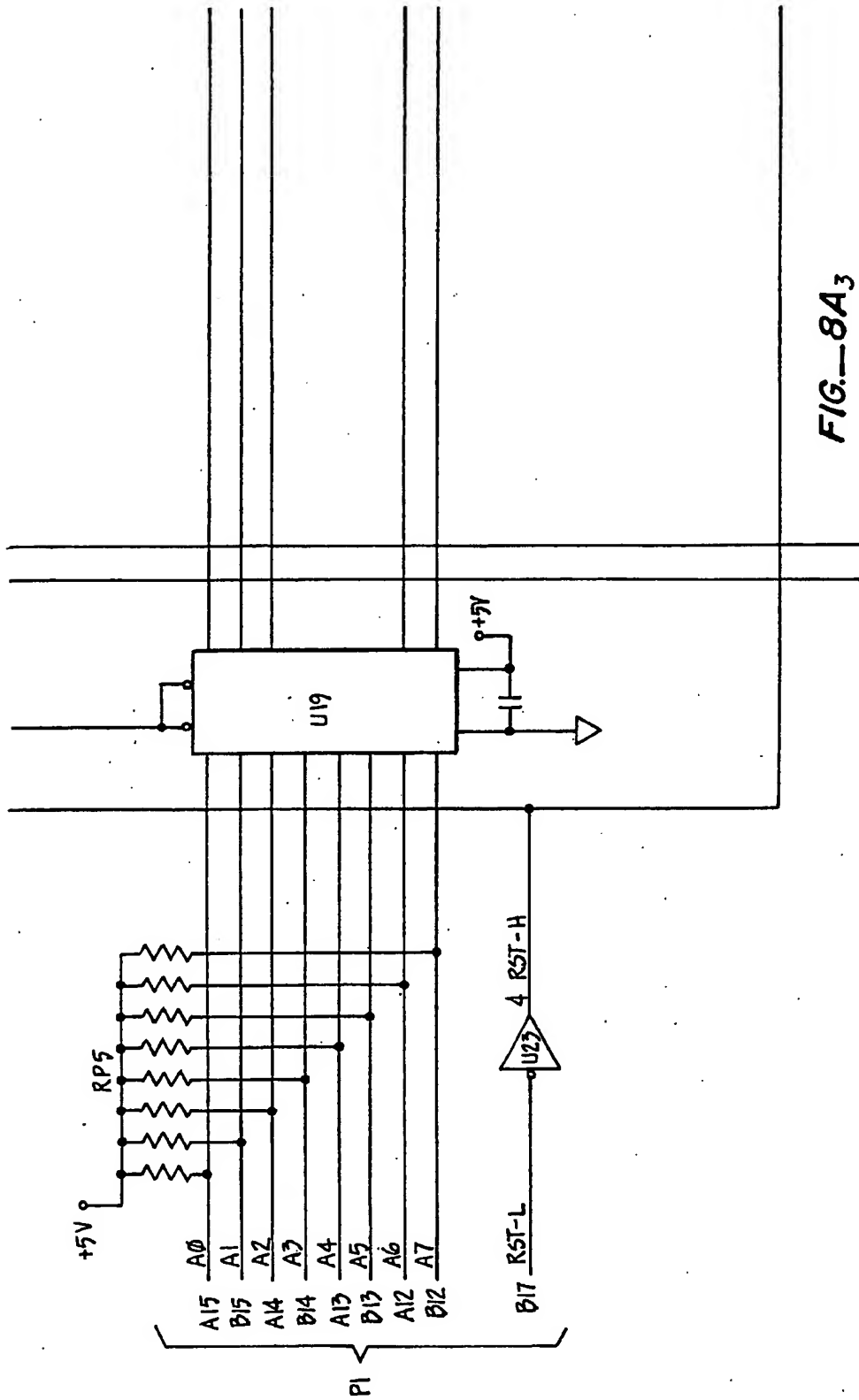
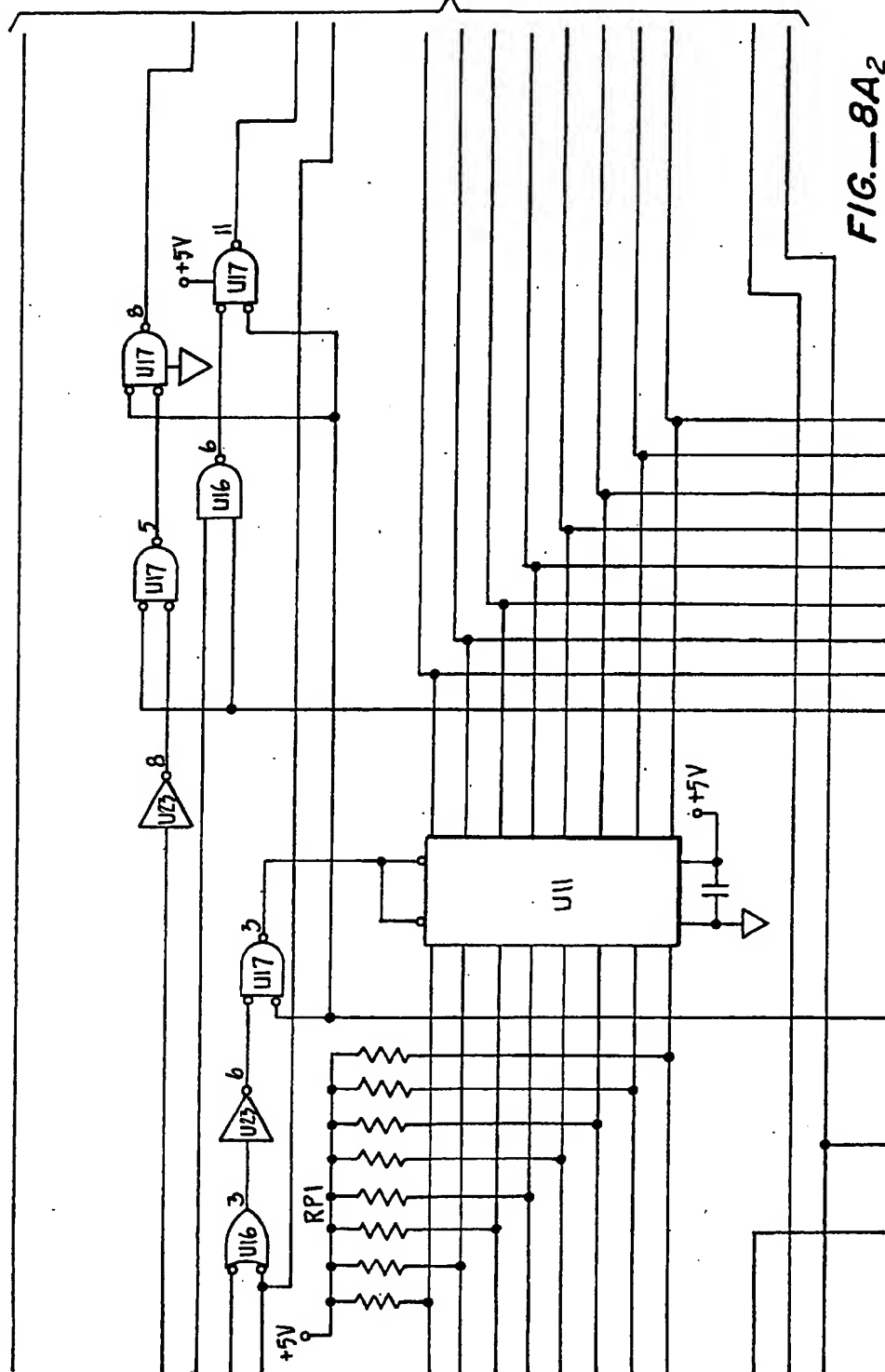


FIG. 8A<sub>3</sub>

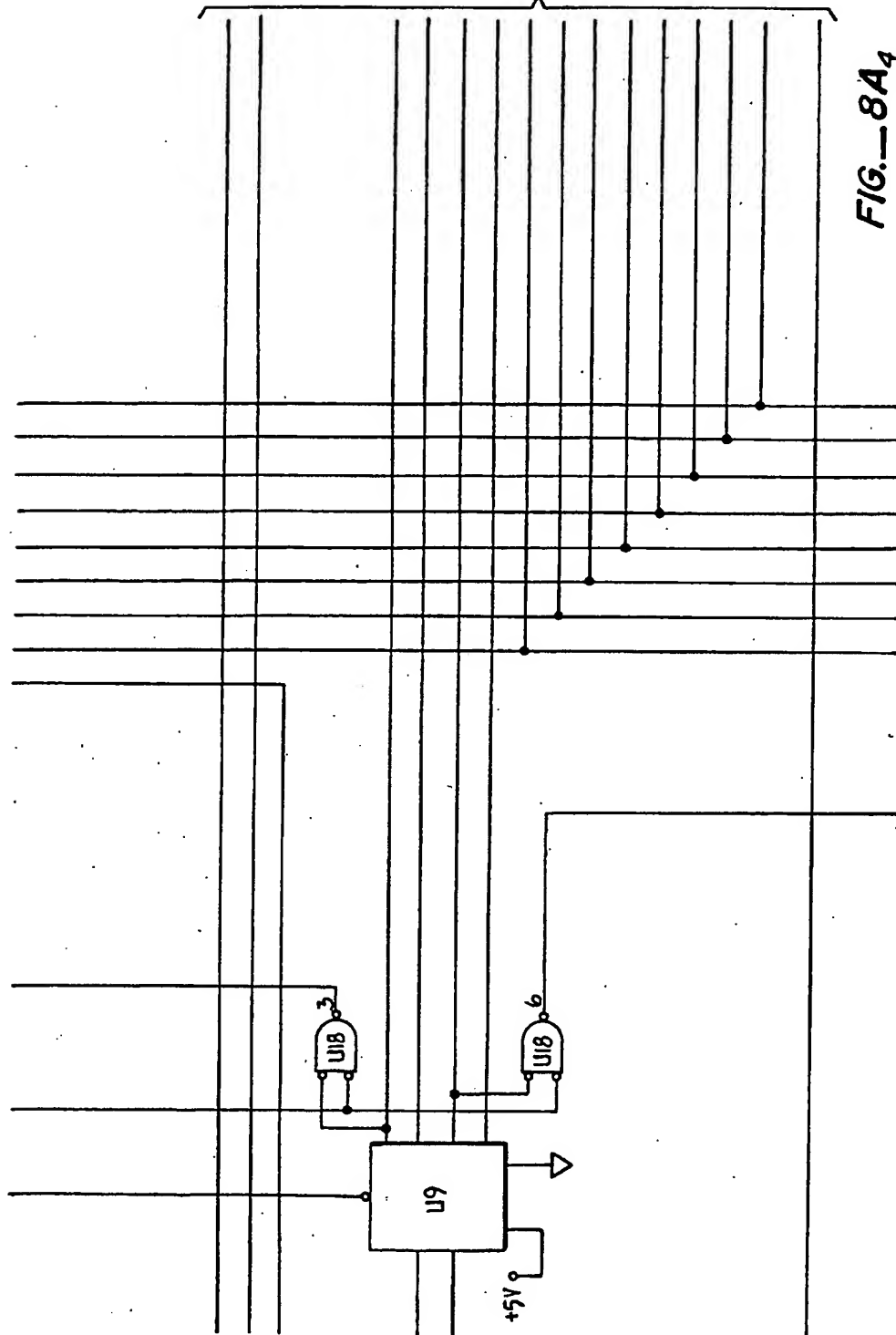


**FIG.—8A<sub>2</sub>**

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FIG. 8A<sub>2</sub>

FIG.—8A<sub>4</sub>



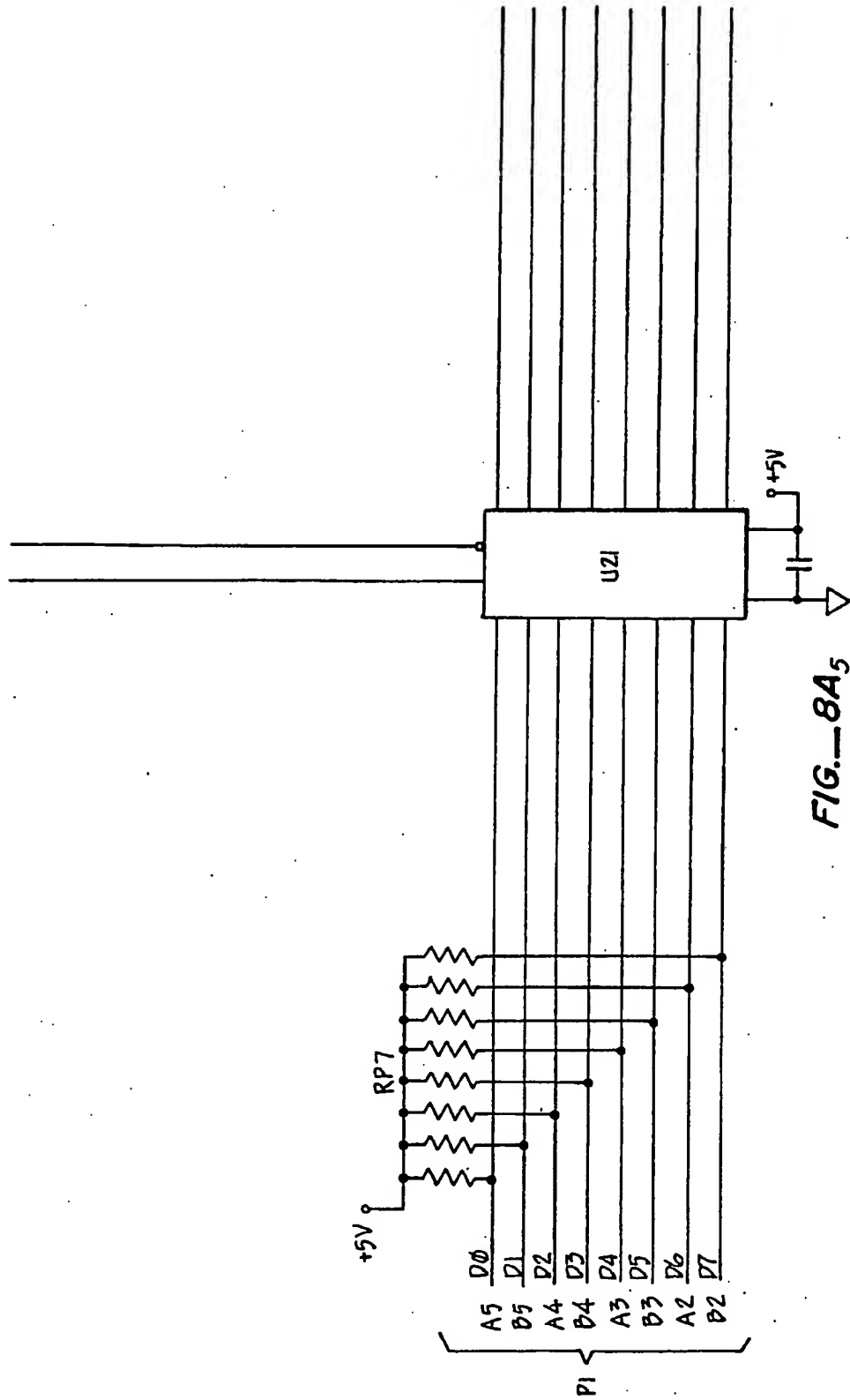
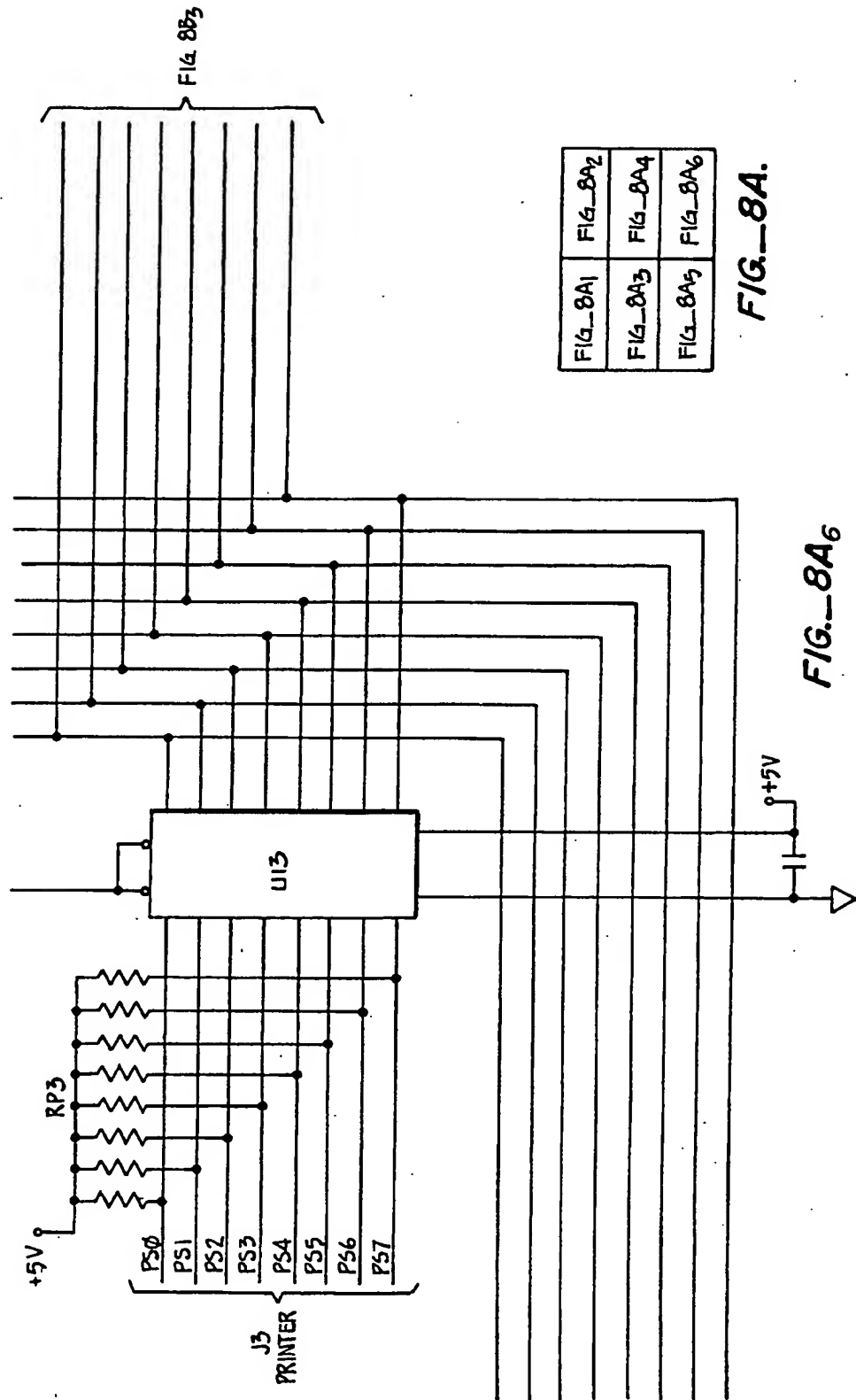
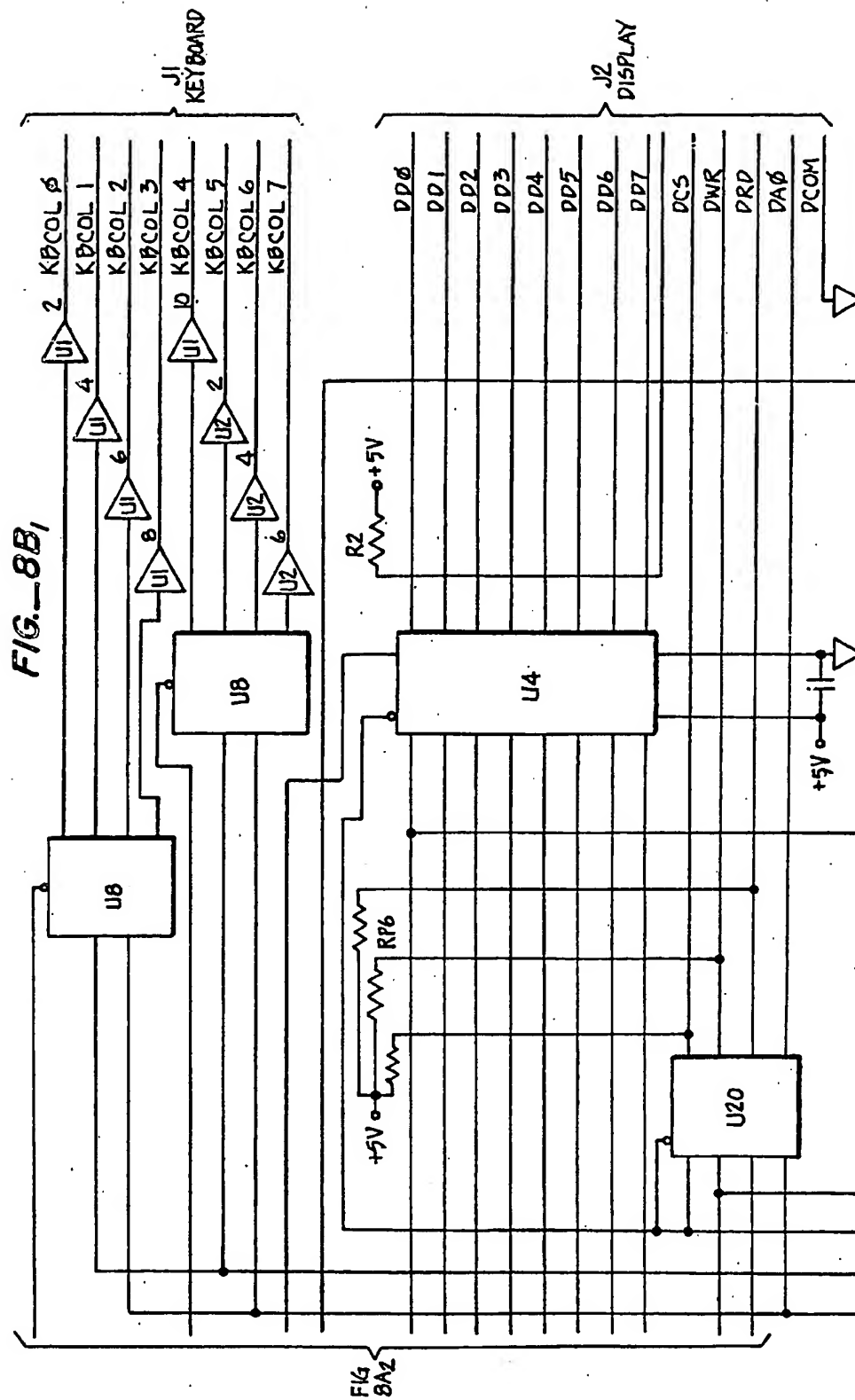
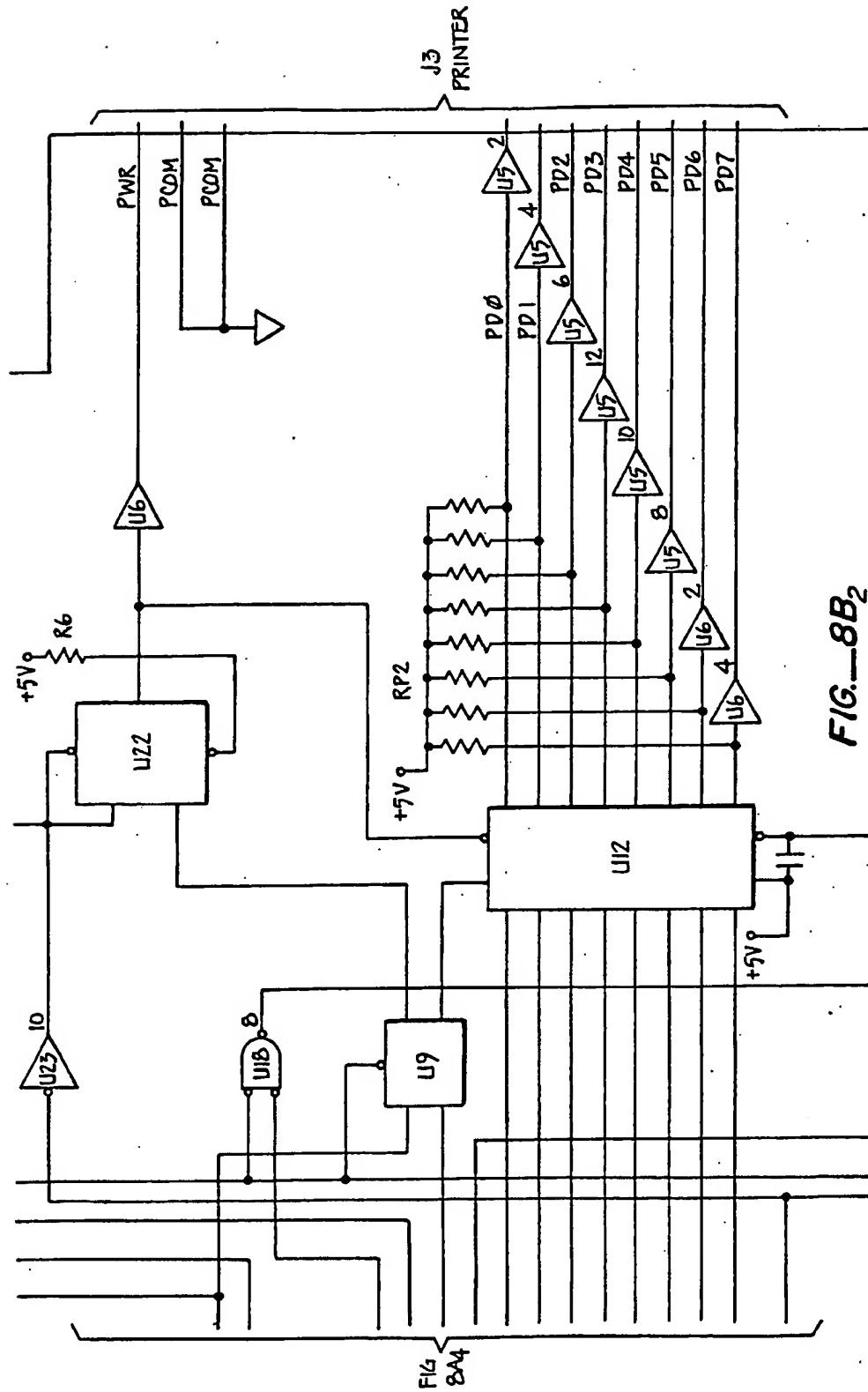


FIG.—8A<sub>5</sub>









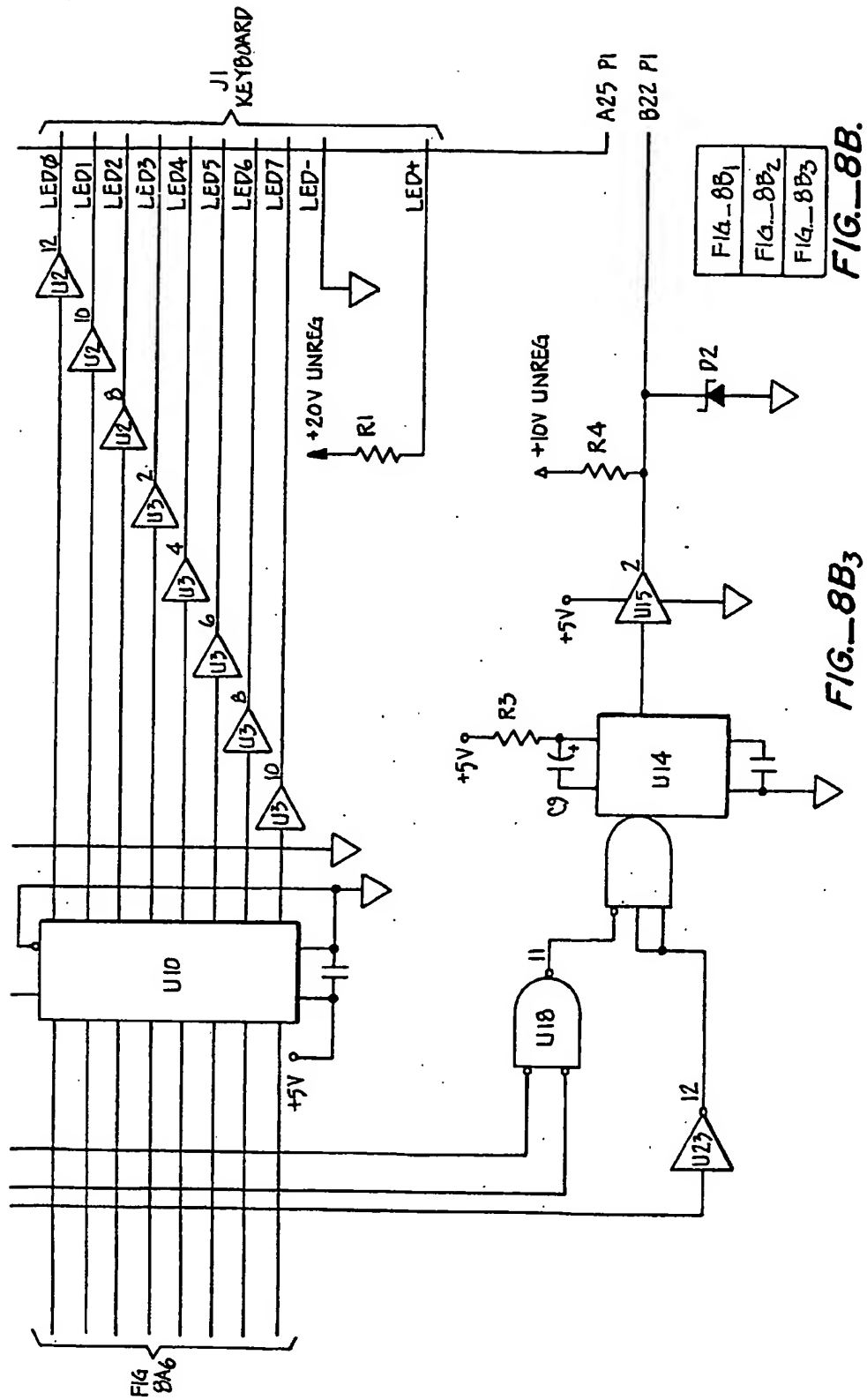
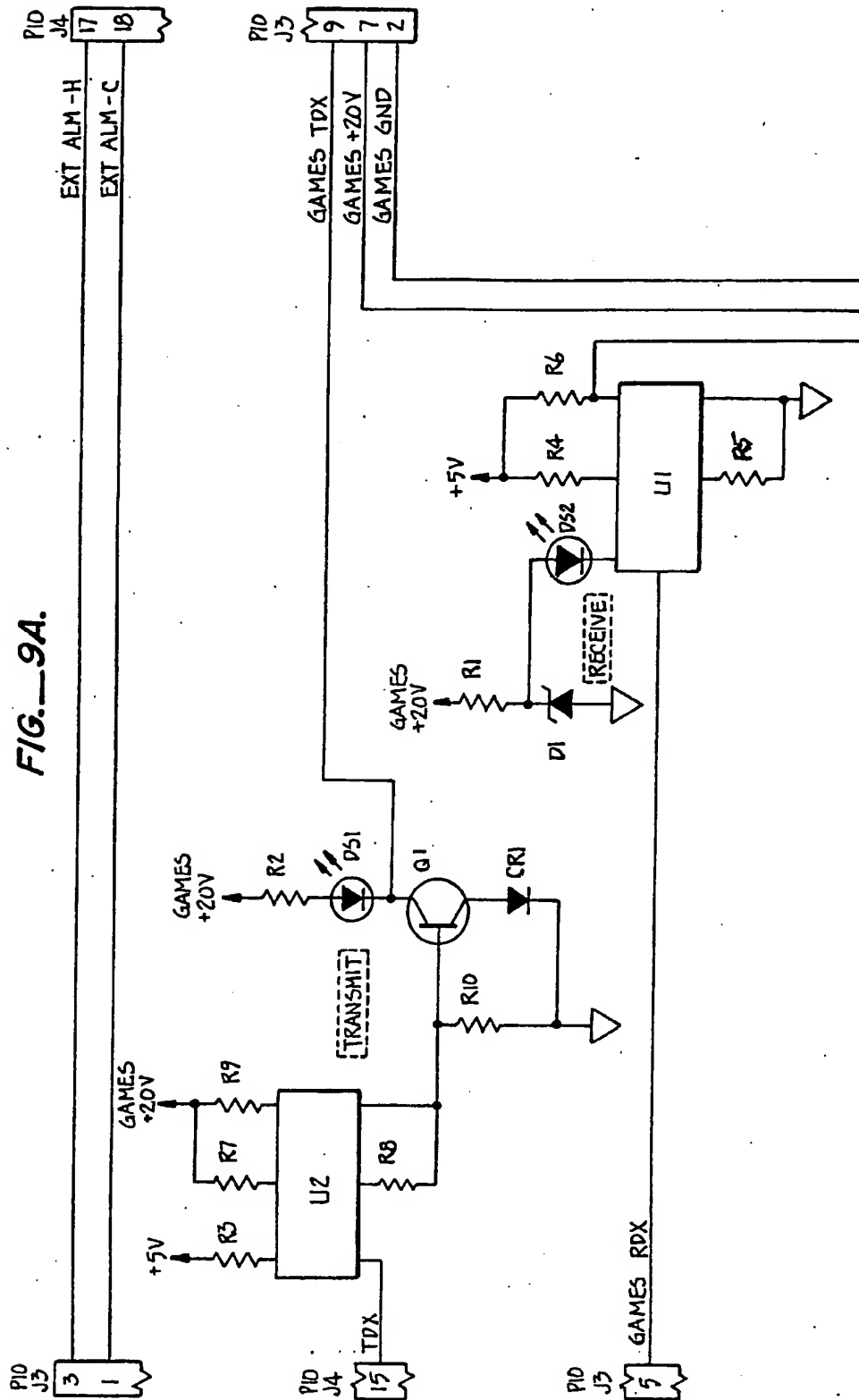


FIG.—9A.



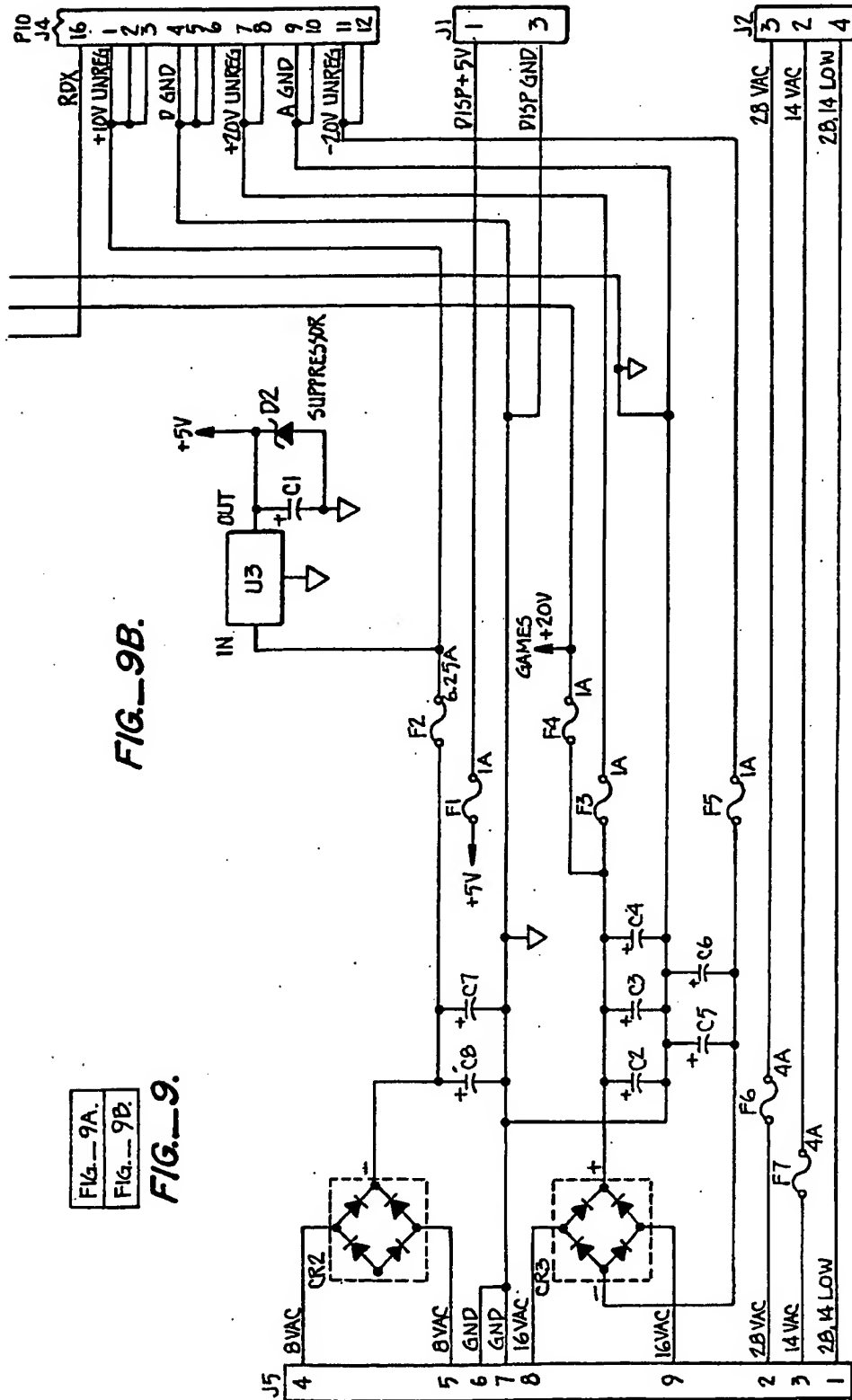


FIG. 9B.

FIG. 9A.  
FIG. 9B.  
FIG. 9.

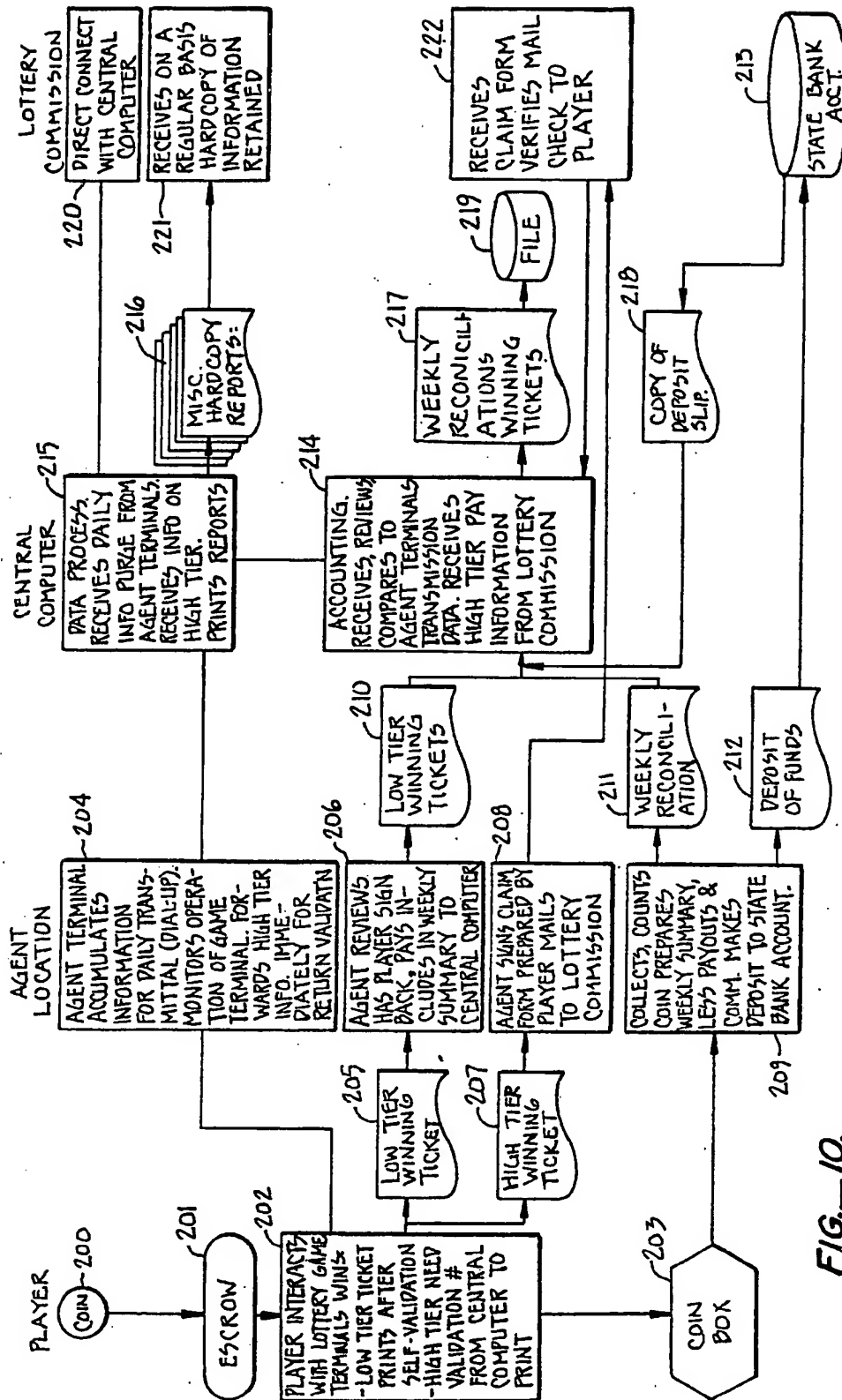


FIG. 10.

## SPECIFICATION

### Video Lottery System

The present invention relates to a video gaming computer, terminal, and game architecture. More particularly, the present invention relates to an electronic video lottery system including a central site computer system, lottery agent terminals, and lottery game terminals.

#### Description of the Prior Art

State run lotteries are well known and popular revenue raising enterprises. Such lotteries are a benign form of taxation that allow the ticket purchaser to buy a chance to win a large cash prize. In exchange for this legalized gambling, the state makes a favorable profit running the lottery. Most lotteries involve the sale of a ticket that may be either an instant winner or scratch-off ticket, wherein the purchaser reveals an obscured number pattern in a matrix to determine if he is a winner; or a large jackpot ticket, wherein the purchaser awaits selection and posting of a winning ticket number.

Recent improvements in solid-state electronic technology have revolutionized casino gambling. For example, video slot machines and poker games are replacing the traditional mechanical slot machines and table poker sessions. Electronic gambling, in addition to being generally more exciting and interesting, also offers a higher level of game security. State lotteries generally lack such security, as is exemplified by the recent presentation of two winning tickets at a state-operated lottery. One of the tickets was a forgery, but it was not palpably different from the valid ticket. As a result, the lottery paid two prizes and significant revenue was thereby lost.

Although some equipment manufacturers such as Bally Manufacturing Corporation of Chicago, Illinois, have proposed video or electronic lottery systems, the seemingly insurmountable problems involved in developing such systems have previously remained unsolved. It is for this reason that state lotteries have been hesitant to adopt a video or electronic lottery system. Among the heretofore unsolved stumbling blocks to the development of a video or electronic lottery system are the following:

- 1) Agent terminal/game terminal intercommunications and security;
- 2) Independent game operation allowing a statewide network of lottery game terminals to operate off of a single central computer system;
- 3) The unavailability of integrated central computer management and data base systems; and
- 4) The actual implementation of such a system in a form reduced to practice, rather than in the form of an unimplemented proposal.

#### Summary of the Invention

The present invention is an electronic video lottery system including a central computer system, a plurality of lottery agent terminals, and a plurality of lottery game terminals. The central computer system consists of three minicomputers

intercoupled on a common network, each of which includes a disc drive memory and a display

terminal. A first of the minicomputers is a primary central processor which creates and maintains a lottery system data base. In the event of primary central processor failure, a secondary central processor is switched to control the data base and system communications. A third central processor provides a management and administrative system, but may also be used as a data base and communications management system, should a system failure require such performance.

A plurality of lottery agent terminals are coupled via answer/originate dial-up modems to the telephone lines and are capable of processing or receiving information from the central computer system. Each lottery agent terminal gathers statistical data from lottery game terminals and transmits the data to the central computer system. The lottery agent terminals initiate communication with the computer system on a high-tier lottery game win or malfunction (including security breaches) as they occur; it provides a hard copy audit trail of all significant events, including copies of all winning tickets; it provides a means of ticket validation and record of payment; and it provides daily and weekly accounting information to the lottery system central computer and to the lottery agent.

Agent terminal/lottery game terminal communications are in the form of serial encrypted data along a serial data bus. Each of a plurality of lottery game terminals is connected in parallel along said serial communications bus. Each lottery game terminal is uniquely identified by hardware and/or software ID labels. In this way, game security is assured.

Intercommunication between the lottery agent terminal and the central computer is on an on-demand basis. Accordingly, a single centralized computer system can handle a very large number of lottery agent terminals, and their associated game terminals, without sacrificing speed or system resource availability. The central computer includes a powerful data base management system that allows it to poll each agent terminal at selected intervals (such as when the system is not available for game play) for significant meter data relating to game activity.

#### Brief Description of the Drawings

Fig. 1 is a block diagram of an electronic lottery system according to the present invention;

Fig. 2 is a block diagram of an agent site installation according to the present electronic lottery system invention;

Fig. 3 is a block diagram of a central computer system according to the present electronic lottery system invention;

Fig. 4 is a block diagram of the central computer system software and data base management system;

Fig. 5 is a block diagram of a lottery agent terminal according to the present electronic lottery system invention;

Fig. 6 is a schematic diagram of a central processing unit circuit used in lottery agent's terminal;

Fig. 7 is a schematic diagram of a CMOS memory used in lottery agent's terminal;

Fig. 8 is a schematic diagram of an interface circuit used in the lottery agent's terminal;

Fig. 9 is a schematic diagram of a power and game terminal interface circuit used in the lottery agent's terminal; and

Fig. 10 is a flow diagram of an exemplary lottery system including a preferred embodiment of the present invention.

#### Detailed Description of a Preferred Embodiment

The present invention is an electronic video lottery system including the following primary elements (shown in Fig. 1):

- 1) A central site computer system 10;
- 2) A plurality of lottery agent terminals located at agent sites 12/14; and
- 3) A plurality of lottery game terminals 45a—h (shown in Fig. 2).

A block diagram of the video lottery system is shown in Fig. 1. The central site computer system consists of three minicomputers 16/20/24 intercoupled on a common network. Each of said minicomputers is accessed by lottery personnel via respective consoles 17, 21, and 25, which include a keyboard for entering data and commands and a display for viewing data.

A primary minicomputer 16 serves as the communications front end and creates a data base on a primary disc memory 18. A secondary minicomputer 20 monitors the performance of first minicomputer 16 and creates a backup data base on a secondary disc memory 22. In the event of a malfunction of primary minicomputer 16, secondary minicomputer 20 switches the communications and performs the role the faulty unit had been performing. In this way, a high degree of security is provided by the redundant nature of the system.

A third minicomputer 24 and associated memory disc 26 is used in a management function, such as creating reports, and also as a third backup for further system security through redundancy. In all cases, very little custom software is used in the present system. Rather, commercially available software modules are operated by a master software module, a copy of which is included as a microfiche appendix to this application.

The three minicomputers are coupled via interface 28 to a 300 line-per-minute, 132-column printer 30. Communications to and from the computer system are multiplexed by multiplexers 32 and 33 (a third multiplexer 34, shown in phantom, may be included if desired). The multiplexed communications signals are then carried on via 300-baud or higher dial-up compatible modems 36. In other embodiments of the invention, higher baud rates are possible, but overall system reliability is maximized by using 300 baud. Further, with a dial-up approach, higher baud rates are not necessary.

The present invention is fully capable of handling 10,000 or more lottery game terminals. To insure security, the central site computer system is equipped with an uninterruptible power supply (not shown) having sufficient capacity to cover temporary power interruption or to bring the site to an orderly shutdown. However, with the dial-up system, the entire lottery network has the capacity to function for several days without the computer system being operational, as is explained in further detail below.

A lottery agent location 12/14 and a lottery agent's terminal 44 are shown in Fig. 2. Lottery agent terminal 44 is a logical extension of the central site computer system and serves the following functions:

- 1) It gathers statistical data from lottery game terminal(s) 45a—c and transmits the data to the central computer system;
- 2) It communicates with the computer system on high-tier wins or malfunctions (including security breaches) as they occur;
- 3) It provides a hard copy audit trail of all significant events, including copies of all winning tickets;
- 4) It provides a means of ticket validation and a record of payment; and
- 5) It provides daily and weekly accounting information to the lottery agent.

Although each agent location is configured to operate between one and five lottery game terminals, one agent terminal in the present embodiment of the invention can control as many as 64 game terminals. Communication between the agent terminal and the central site computer is via a self-contained, autodialer 108 and originate/answer modem 106 (as shown in Fig. 5).

Each agent terminal has two levels of data encryption and decryption:

- 1) Level 1 is used to and from the lottery game terminal; and
- 2) Level 2 is used to and from the central site computer system.

Each agent terminal has a battery backed-up CMOS RAM (complementary symmetry metal oxide semiconductor random access memory) module (101 in Fig. 5) that prevents loss of data in the event of a power failure. A memory module having a similar back-up scheme is described in detail in Patent Application Serial No. 447,358, entitled Look-Ahead State-Saving Device, filed 6 December 1982, and assigned to the assignee of the present invention, IGT Corporation of Reno, Nevada.

Each agent terminal has a CMOS real time clock (102 in Fig. 5) including a battery back-up. The real time clock is set by command from the central site computer system. The agent terminal is also equipped with a printer (107 in Fig. 5) to record high tier wins, cash out events, malfunctions, and statistical and accounting data. All printer events are date and time stamped. A keyboard (94 in Fig. 5) is also included to allow the agent to validate winning tickets, obtain printouts of lottery game performance, and commence or terminate play at the location.

A low tier winning ticket (low value) is printed at the lottery game terminal when a player with accumulated winnings presses a Collect Winnings button (not shown) on the lottery game terminal.

5 The ticket is printed only after the agent terminal is notified and grants permission to the game terminal to do so. A copy of the ticket is also printed on the agent terminal as an audit trail and for validation purposes. The player then presents his winning  
10 ticket to the agent, who verifies the special ticket paper and enters the validation number on his keyboard. A 20-character display (104 in Fig. 5) indicates the winning amount, game type, time, and date. The agent then make payment and indicates  
15 "paid" on the agent terminal. The transaction is recorded on printer 107. Typically, the agent keeps the ticket. Winning tickets that are not redeemed on the same day by the appropriate agent are processed through a lottery claim center.

20 A high tier win (large amount) causes a printout at the lottery agent terminal and initiates a communication to the central site computer system to inform the system of the win. When the computer system has verified the high tier win information, it  
25 permits the agent terminal to print the high tier winning ticket. If, for any reason, after several attempts, the computer system cannot be reached, the winning ticket is printed, the win information is stored locally, and the computer system is updated  
30 when it is next available. The high tier win must be redeemed in person at, or by registered mail to, the lottery Validation is accomplished by interrogation of the data base in the computer system. The agent terminal printer provides an additional audit trail.

35 The lottery game terminal should be of a type that provides maximum flexibility and reliability. These requirements are necessary because the game terminal is subjected to heavy use for many years. Additionally, the game terminal must accommodate  
40 future games that have not yet been created. The lottery game terminal is typically of a microprocessor controlled type, such as that described in the copending patent application entitled Lottery Game Terminal, no. 8423030 and  
45 assigned to the assignee of the present patent application, IGT Corporation, of Reno, Nevada.

The lottery game terminal should be attractively styled; it may be for either sitting or standing use. To encourage game play, the lottery game terminal  
50 should include a color video display, ticket printer, and two coin entry slots for quarter and dollar play. Player interaction should be accomplished with push buttons and/or a light pen.

The above referenced lottery game terminal uses  
55 a dual processor architecture to insure maximum flexibility in implementing new games. The lottery game terminal control logic performs the following functions:

60 1) Transmits all game play data to the controlling agent terminal;  
2) Monitors data from the input/output logic to detect:  
a) insertion of coins;  
b) activation of switches by players during normal  
65 game play;

c) activation of switches during terminal maintenance;

d) activation of switches in accounting and jackpot verification modes; and

70 e) attempts at cheating;

3) Provides data to the output logic to cause:

a) winning tickets to be printed;

b) mechanical accounting meters to be updated;

c) sound effects to be played;

75 d) lights and indicator lamps to be illuminated as required; and

e) further play to be inhibited by preventing the insertion of coins; and

80 4) Provides data to the video logic to keep the game video screen properly updated during all modes of operation.

A block diagram of the central site computer system is shown in Fig. 3. Each lottery agent terminal can communicate with the central site computer system via telephone, and is capable of dialing the computer system or answering calls from it. Transmission to the computer system occurs whenever there is a high tier win, a security violation, or an equipment failure at an agent's  
90 location. Vital information concerning the transmission is displayed on the computer system's console display (17, 21, or 25). If desired by the lottery, this notice could be displayed on the management reporting station (40) at the lottery  
95 commission's administrative offices.

During a maintenance interval, when lottery game terminals are not in play, the central site computer system calls every lottery agent terminal to obtain accounting data. After checking the information for completeness and accuracy, the computer system disconnects the interrogated agent terminal from the phone lines and calls the next agent terminal. As with all communications to and from the lottery agent terminals, these transmissions are encrypted to prevent unauthorized monitoring or manipulating of the data. A full ACK-NA key (acknowledge/not acknowledge) protocol with error detection is implemented. Retransmission occurs automatically in the event of transmission error. Erroneous  
110 transmissions are reported to the computer system operator for investigation.

Alternate actions received from the agent terminals are redundantly stored in a data base in the computer system (see Fig. 4). The data base may be interrogated, reported, or copied to magnetic  
115 tape for computer analysis.

The central site computer system contains three discrete central processor units—a primary system 16, a secondary system 20, and a management  
120 system 24. Primary system 16 polls each of the agent's terminals daily, receives incoming calls reporting prize and maintenance information, and updates its data base with the latest accounting and transaction information. Secondary system 20  
125 constantly monitors the incoming information via an interprocessor communications link 54/62 and 55/63, updates its redundant data base, checks the validity of the incoming data, and verifies that the primary system's reaction to that data was correct. If  
130 the secondary system detects a problem with the



primary system, it notifies the operator and automatically assumes the role of the primary system. Management system 24 maintains a third copy of the data, and generates reports for the

5 lottery. The management system can also assume the role of primary system to the other computer system should the primary system fail.

A number of safeguards to protect personnel, property, and integrity of the data base are  
10 implemented at the computer center. The following details some of the safety equipment installed at the central site according to the present invention. An uninterruptible power supply is installed to insure continued operation of the central site computer  
15 system during power failures. Even though operation of the lottery game terminals may continue for an indefinite period of time without any intervention from the central site computer system, an uninterruptible power supply is an additional  
20 measure of protection against brownouts, full power failures, and surges. An alarm notifies the operations staff that a power failure has occurred. The uninterruptible power supply is capable of maintaining power to the central site computer  
25 system in the event of temporary power loss.

The central site computer system is an integrated software/hardware system. All central site computer system components may be purchased from major manufacturers. In selecting hardware, strong  
30 emphasis is given to equipment with demonstrated reliability. The present invention incorporates minicomputers manufactured by the Digital Equipment Corporation (DEC) of Cambridge, Massachusetts. Three DEC PDP-11/24 16-bit  
35 minicomputers form the central site computer system. Each central processor (50, 58, and 66) includes 256 kbytes of random access memory (52, 60, and 68), with an expansion potential to 4 million bytes. Memory expansion is possible, in part,  
40 because of the inclusion of a physical address extension circuit (51, 59, and 67) associated with each central processor (50, 58, and 66).

Two types of mass storage are employed by the central site computer system:

- 45 1) Magnetic disc (18, 22, and 26) using Winchester recording technology; and
- 2) Industry standard IBM compatible magnetic tape (29).

A DEC RA-80 cabinet-mounted disc drive or  
50 Winchester fixed disc drive is combined with a DEC UDA-50 disc controller at a disc controller (53, 61, or 69). This combination provides storage capacity for 121 Mbytes of data. Twelve vectors of buffering provide a transfer rate of 1.2 million bytes per  
55 second. Fixed disc technology improves reliability since the storage medium is never exposed to contaminating elements.

The DEC UDA-50 disc controller reorders up to twelve I/O (input/output) requests in a command  
60 queue to minimize seek time in single or multidrive configurations. The preferred embodiment of the present invention includes one DEC RA-80/UDA-50 storage disc drive and disc controller for each central processing unit. Up to four DEC RA-80 disc  
65 drives may be attached to each DEC UDA-50

controller for an expansion capacity of 484 million bytes of on-line storage for alternate embodiments of the invention. Two DEC UDA-50 controllers may be provided on each DEC PDP-11 central processing  
70 unit.

A single DEC TE-16 magnetic tape drive 29 is included in the preferred embodiment of the present invention. The DEC TE 16 magnetic tape drive stores data at 800/1600 BPI (bits per inch) and is connected  
75 to the management computer system. System software provides for ANSI or unlabelled magnetic tape formats which may be interchanged with IBM 3420-8 magnetic tape units currently used by many state lotteries.

80 Each central processor unit is interfaced to the other two central processor units via a high speed interprocessor communications link 54/62/70 and 55/63/71. Any time an update to the on-line data base is made on any computer system, the  
85 remaining two are notified of the change through this link.

A single 300 line-per-minute printer/plotter 30 is provided for printing reports, graphs, charts, etc. at the computer center. Each central processor unit  
90 has a video console terminal (17, 21, or 25). All diagnostic messages are displayed on this terminal. A system operator can also direct the operations of the computer next to the support software from these consoles. An alarm (not shown) alerts the  
95 operator to potential problems.

Voice grade telephone lines are required and are typically supplied by the local telephone company. The lines are on a "rotary" system (42 in Fig. 1) which automatically places an incoming call on the  
100 first available phone line. Modems 75a-75d, which provide an interface between the central site computer system and the telephone lines, may be of the type supplied by Rixon, a division of Sangamo/Schlumberger, of Switzerland. Each modem can  
105 communicate at either 300- or 1200-baud over dial-up or leased (dedicated) telephone lines. Automatic call answering and dialing is configured into the modem hardware. Surplus capacity is provided to prevent a bottleneck should a modem  
110 fail during unusually high communications traffic, such as during times of peak game play.

An electronic switch 74a-74h is provided to switch the modems between the three computer systems. The switch is actuated by the  
115 interprocessor integrity checks. If the primary system fails, the secondary system detects the failure and takes control of the modems. Multiplexers 32-34 interface the modems to each central processor unit, may be of a type supplied by  
120 Emulex of Santa Ana, California. Each multiplexer has the capacity to interface 32 modem lines to an associated central processor via an associated port module (56, 64, or 72). Up to four 32-line multiplexers may be included in the preferred  
125 embodiment of the invention for a total of up to 128 dial-up communication lines.

A number of remote terminal units 38, some with hard copy printers 41, may be provided for use by lottery personnel. These units provide Inquiry/  
130 display functionality, in addition to validating

winning tickets. Up to four remote stations may be included in any combination of report or validation terminals required by the lottery.

Each remote terminal uses a dial-up or dedicated leased telephone line to the central site computer system and a pair of 1200-baud modems 39a/48, one modem at each end of the communications line. A DEC video terminal 40 with keyboard printer may be used to provide inquiry and file maintenance function access. A 120-CPS (characters per second) hard copy printer 41 is also supplied with the management report station. Most system reports are printed on these devices. If desired, a maintenance printer 76 may also be included to provide an audit trail of system operation and communications.

A block diagram of the central site computer system software and data base management system is shown in Fig. 4. All system software described in this application (unless otherwise specified) may be of a type supplied by Digital Equipment Corporation. Accordingly, off-the-shelf operational and tested software is used wherever possible.

The DEC RFTS/E timesharing system for minicomputers is used. With this system, up to 127 users can be currently active, given sufficient hardware to support processing requirements. Full interprocessor timesharing is available with the addition of DECNET/E.

The DEC RFTS/E timesharing system has the added advantage of providing optional software components which allow direct communication with remote IBM mainframe computers. The "cross vendor" communication option provides full compliance with IBM S and A (system network architecture) protocol. DEC RJE/HASP communications are also available for use with the present invention.

A lottery accounting data base system 78 is implemented using the DEC RMS-11 record management system. The DEC RMS-11 record management system provides a record management system having sequential, random, or index access of any filed defined data base. Up to 225 keys can be used for the record access. A DEC RMS-11 utility 81 is supplied for copying the data base to an IBM compatible ANSI or unlabelled magnetic tape for analysis on another computer, if desired.

The DEC RMS-11 record management system data base organization is transparent to a system user. All inquiries of the data base are performed using a utility report generator 80, such as the DEC Datatrieve report generator. The DEC Datatrieve report generator allows the user to access the data base using an English command directive. A full user command assistance facility is provided by the system.

Interprocessor communications software 154/155 may be of the type such as the DEC DECNET/E communications program. Facilities are provided for transferring files across computer systems, accessing files on one computer from another, and downloading system software to an auxiliary

processor unit. The DEC DECNET/E communications program communicates using DNA (digital network architecture), or protocols.

A novel front end communications program 86 (a listing of which is included as an appendix to this application) interfaces the modems to data base 78. Modem control program 86 transmits and receives characters over the dial-up telephone lines to and from agent terminals.

Security and data integrity are of primary concern in dealing with remote communications. A full protocol supporting error detection with ACK/NA key transmission and full data encryption is implemented in the present invention. Trouble situations, such as garbled transmission or potential security violations, are immediately reported to the system operator.

Modem control program 86 interacts with the DEC DECNET/E communications program for transmitting incoming messages from one central processor to the other two central processors. Directives may also be received from the system operator at interprocessor integrity check software 84 to request that a particular modem control program take charge of the modems.

An interprocessor modem switch is actuated by modem control program 86. Interprocessor communications are under the control of the DEC DECNET/E communications software. Full error detection and retransmission of inaccurate data are supported by this system.

The present invention includes a modification to the DEC DECNET/E communications program that checks the integrity of the primary central processor. This modification accompanies the computer program listing included as an appendix to this application. If an error is found with the primary central processor's processing of a network message, the DEC DECNET/E communications program directs modem control software 86 to switch the modems to the secondary central processor.

Data base 78 is broken into several unique file entries including the following:

1) Transaction file (daily poll software 87)—the transaction file records summary transaction data for each lottery game terminal. Both incoming and outgoing switches are retained, allowing lottery personnel to see the summary of all activity at any given lottery game terminal;

2) Accounting histories—accounting histories summarized as follows: daily, week-to-week, month-to-day, year-to-date, this-day-last-month, and this-day-last-year information is maintained for each lottery game terminal. Items recorded for each accounting period include coins in, winnings paid, free-plays, wins, and maintenance control information;

3) Network configuration files 88—the network file records equipment locations, the last maintenance activity (stored in network maintenance file 89), site configurations, machine types, phone numbers, and date/time of last transmission.

When the lottery games are shut down for maintenance intervals (generally under control of

file maintenance functions software 79), the central computer system calls each agent terminal and requests the daily accounting summary. The daily accounting summary is posted to a daily accounting file by daily poll software 87 for subsequent posting to data base 78.

Should a communication be interrupted, the agent terminal is redialed and another attempt is made to receive the accounting information. After a predetermined number of unsuccessful attempts, the system operator is alerted by maintenance inquiry and reporting software 82 and the details of the prompt are displayed to allow immediate dispatch of service personnel.

After each lottery agent terminal has been contacted, a background processing program (data validation software 83) posts the data received to data base 78. A report is printed under control of report generator 80 listing each agent terminal that did not respond to the poll or that did not transmit correct data. The daily accounting summary is also printed at this time.

A number of utility programs are provided with the present invention for interaction with the data base from the video display terminals. These programs also provide validation of wins and management inquiry functions. These validation and inquiry functions are available with each of the remote validation and management report stations.

All changes made to the data base are logged in an audit trail. The audit trail includes an indication of who made the change, when the change occurred, and the location of the terminal from which the change was initiated. A complete system of access codes and authorization parameters is maintained by the system's operation staff to prevent unauthorized access to the data base. State lottery officials may assume the responsibility of issuing authorization levels and passwords if they so desire. As indicated above, an English language report generator 80 is used for custom printing of "on demand" reports. The report generator allows report formats to be stored on disc and recalled using a single command such as: "print daily sales report".

In the exemplary embodiment of the present invention, three types of communications links exist;

1) the modem lines from the central site computer system into the CRT terminal at the lottery headquarters;

2) the modem link between each lottery agent terminal in the computer system; and

3) the hardwired link between each lottery game terminal and its associated lottery agent terminal.

Communications between each lottery agent terminal and the computer system use a 300-baud modem link. The data sent over these links is encrypted by data encryption software 83 according to the DES data encryption standard promulgated by the National Bureau of Standards under the auspices of the National Security Administration. The only communications initiated by the central site computer is a game shutdown (either statewide or individual games), and a once per day data

collection request. All computer system data collection occurs during system off hours for daily accounting, exception reporting, and uncashed low tier ticket information. The lottery agent terminals

Initiate communication with the computer system for all high tier wins, and any major game exceptions, such as attempts at tampering.

Communication between each lottery agent terminal and its associated lottery game terminals is on a single, three-wire serial data link at 4800 baud. All communications on this link are initiated by the lottery agent terminal and in the form of encrypted messages. Each lottery game terminal (up to 64 in a single agent terminal), is polled within two seconds for any pressing items such as high tier wins, cashouts, and invalid door openings.

Lottery agent terminal 12 (Fig. 5) requests and receives a complete set of each lottery game terminals data meters within a two minute interval. In addition, the lottery game terminal meters may be requested within two seconds of the occurrence of any pressing item during game play. If any lottery game terminal is not polled within an eight second span, the lottery game terminal declares the lottery agent terminal inoperable, and shuts down upon completion of any game in progress. If any lottery game terminal does not respond to a poll by the lottery agent terminal, the lottery agent terminal declares that lottery game terminal shut down, and does not allow it to resume play until a check is made of its data meters and its program code has been verified.

Messages between the game and agent terminal and vice-versa are generally of the following format:

1) Address byte. This is the address of the game responding or being polled.

2) Function code byte. This code indicates the function being requested or performed. For example, the agent terminal might send a soft down command and the game should respond with an acknowledgement of the soft down.

3) Checksum. This byte is chosen so that the sum (modulo 256) of all the bytes in the message is FF hex. When either the agent terminal or the game receives a message with a bad checksum, it ignores that message and proceeds as if the message had never been received.

The messages that do not follow the above 3-byte format are in the following general form:

1) Address byte as above.

2) Function code byte as above.

3) Length byte. This byte contains the length of the entire message starting with the address byte and ending with the checksum byte.

4) "Other data" depending on the particular function.

5) Checksum as above.

The function codes sent by the agent terminal are:

0 POLL (Status is on-line)

1 POLL (Status is soft down)

2 POLL (Status is hard down)

3 Request meters

4 \*Cash-out ticket data

The hex function codes sent by the game are:

0 ACK (Nothing to report)

1 ACK (Cash-out in progress)  
 2 ACK (Door is open)  
 3 ACK (Paper out)  
 7—B ACK  
 5 C ACK (Bad escrow tilt)  
 10 \*Meter data  
 11 \*Cash-out request including CREDIT meter  
 For the "cash-out ticket-data" function, the "other data" consists of:  
 10 1) 4 bytes of authorization number;  
 2) One print line consisting of the date and time in ASCII; and  
 3) The name and address of the agent (multiple ASCII lines).  
 15 Multiple consecutive spaces are coded as 80H+xx where xx is the number of consecutive spaces to print.  
 For the "meter data" function, the "other data" is:  
 20 4 bytes (MSD first) for CCTOT (cash total)  
 4 bytes (MSD first) for SBATOT (Susan B. Anthony dollars total)  
 4 bytes (MSD first) for CITLT  
 4 bytes (MSD first) for RSTOT  
 4 bytes (MSD first) for DOORS  
 25 4 bytes (MSD first) for CITOT (coins-in total) for game 1  
 4 bytes (MSD first) for COTOT (coins-out total) for game 1  
 4 bytes (MSD first) for CPTOT (coins played total) for game 1  
 30 4 bytes (MSD first) for LOTOT (total losses) for game 1  
 4 bytes (MSD first) for WNTOT (total wins) for game 1  
 35 4 bytes (MSD first) for FRETOT (total free games) for game 1  
 4 bytes (MSD first) for GP2 for game 1  
 4 bytes (MSD first) for GP4 for game 1  
 40 32 bytes for CITOT—GP4 for game 2 if applicable  
 32 bytes for CITOT—GP4 for game 3 if applicable  
 32 bytes for CITOT—GP4 for game 4 if applicable  
 32 bytes for CITOT—GP4 for game 5 if applicable  
 For the "cash-out request" function, the "other data" consists of 4 bytes (MSD first) for CREDIT.  
 45 All communication is initiated by the agent terminal. The agent terminal polls all addresses from 0 to 63 in sequence. Each game that is present responds to every message sent by the agent terminal.  
 50 Normally, the agent terminal sends one of the POLL functions and the game responds with one of the ACK functions. This way, the agent terminal constantly controls whether the game is up or down, and the game constantly informs the agent terminal of its status. The agent terminal therefore keeps track of the game's previous status to accommodate CHANGES in status from the game.  
 The most common exception to the POLL/ACK sequence is when the agent terminal requests meters. The agent terminal sends a meter request and the game responds with the meter data message. No additional communication (ACK's or NAK's) is required. If the agent terminal does not

receive a valid set of meters, it asks for them again (up to three times) when that game comes up in the polling sequence the next time around.

The cash-out sequence is the most complicated. The agent terminal sends a POLL to the game, and the game responds with a cash-out request including credit meter. On the next polling sequence, the agent terminal sends the cash-out data to the game. The game replies with the ACK/cash-out in progress code. The agent terminal can process only one cash-out at a time. Therefore, if a game requests a cash-out while a cash-out is being processed or while the agent terminal is trying to get authorization from the central computer system for a high tier win, the agent terminal ignores the request until it can process it. If the agent doesn't send the cash-out data, the game requests it again. While the game is printing the ticket, the agent terminal POLLS as usual and the game responds with the ACK/cash-out code. When the game finishes cashing out, it sends the ACK/  
 85 Nothing to report code in response to POLL's to let the game know it is finished cashing out.

If either processor receives a message that does not fit into this scheme, that message is ignored. Examples are:

- 90 1. Responses from the wrong game.
2. Unsolicited meter data messages or cash-out data messages.
3. Responses other than meter data when meter data is requested.
- 95 The preferred embodiment of the present invention provides a two-second limit on a complete polling sequence of all 64 games. To poll 64 games in two seconds, the agent terminal is allowed 31 msec per game. With three characters being sent each way, the polling process uses only 13 msec at 4800 baud. Accordingly, there is adequate time left for interrupt latency and processing. If the agent terminal times out after 25 msec when a complete message is not received (except when requesting meters), the game terminal has adequate time to be within the 31 msec limit. (The timer starts when the first character of the polling message is sent.)
- 100 When it is time for the agent terminal to collect meters, it asks the first machine for meters and all other machines receive their normal POLLS. Then on the next polling sequence, the second machine is polled. The worst case here is if one machine responds with meters while the other 63 time out. This would be (not including interrupt latency, etc):  
 105 25 msec\* 64 machines+375 msec for transmitting meters=1.975 seconds.

The worst case for cashing out is 63 timeouts and one game requesting a cash-out and receiving immediate authorization. Depending on the amount of print data, this could take slightly over two seconds.

A block diagram of lottery agent terminal 12 is shown in Fig. 5. The exemplary embodiment of the lottery agent terminal includes a keyboard 94 which provides agent maintenance inputs into an agent terminal system data bus 98. Keyboard 94 initiates lottery game terminal start/stop, low tier win validation, encryption key entry, and testing modes.

An agent lock 97 enables the lottery game terminals to start/stop and to issue low tier win validations. A security lock 98 enables all agent lock functions, plus encryption key entry and maintenance. Security lock 96 also provides physical access to terminal cabinet electronics assemblies and disables tamper sensing devices 95. An isolated internal input is provided to report a burglar alarm, or other alarm.

10 An agent terminal control system 92 is a microprocessor-based circuit that communicates with agent terminal inputs 90, a control system support circuit 91, agent terminal outputs 93, and agent terminal communications 99 via system data bus 98 and also by agent terminal direct lines. Control system 92 software is in a non-volatile memory within the control system. The software controls all agent terminal functions. An exemplary listing of the agent terminal software accompanies a microfiche appendix included with this application.

20 Data memory 101 is 64 kbytes of battery backed-up random access memory. All lottery game terminal meters, cash transactions, and alarms are stored in this non-volatile memory. The battery provides at least 15,000 hours (625 days) of memory retention over a five year period and may be of a lithium or other such long life type. Data memory 101 is a removable module under security lock. In the unlikely event of a massive failure in the agent terminal, the data memory module can be transferred to the new agent terminal with no loss of stored data.

Secure memory 100 contains 2 kbytes of battery backed-up random access memory. Encryption keys and other secure data are stored here. When tampering is detected, and security lock 96 is not in the "on" position, secure memory 100 contents are erased by agent terminal hardware and software. Without the security information, a lottery agent terminal which has been stolen or tampered with could not communicate with the central site computer system and would therefore be useless.

Real time clock 102 provides year, month, date, hour, minutes, and seconds for winning tickets, cash transactions, and alarms. Real time clock 102 is backed-up with the same battery used for secure memory 100. Similarly, if tampering is detected, real time clock 102 memory contents are erased by agent terminal hardware and software. The time may only be set by the central site computer system. A lottery agent terminal which had been tampered with can not provide a correct time stamp to a winning ticket.

55 The agent terminal includes a display 104 to provide visual feedback to the agent or maintenance person. Display 104 has full numeric display capability. Control system 92 software controls display 104 with commands issued over system data bus 98.

60 A printer 107 is included to provide a hard copy journal record of lottery agent terminal transactions. Printer 107 is a dot matrix Impact printer in the present embodiment of the invention, to allow multiple paper copies to be used. The printed paper is rolled up within the lottery agent terminal. A

paper load sensor (not shown) provides a front panel alarm. Access to printer 107 for paper or ribbon changing is provided under control of agent lock 97. This arrangement prevents unauthorized

70 access to any other part of the agent terminal electronics assemblies or wiring. Printer 107 is controlled by control system 92 software with commands issued over system data bus 98.

A chime 105 is included to provide audible feedback to the agent terminal operator or maintenance person. Chime 105 verifies keyboard entry and also provides alarm indications. Control system 92 software controls chime 105 by commands issued over system data bus 98.

80 The agent terminal includes alarm LEDs (light emitting diodes) 106, to provide information to pinpoint a failure in the lottery system. Alarm LEDs 106 are controlled by control 92 system software by commands issued over system data bus 98. Any

85 failure of the alarm circuit produces a condition that causes alarm LEDs 106 to be illuminated. Alarm LEDs 106 include the following indications: agent terminal failure, lottery game failure, central site communications failure, printer paper low (on agent terminal printer 107), and battery low (on agent terminal back-up battery).

A computer system failure alarm indicates that the central site computer system cannot be contacted after it has declared itself shut down. A lottery game failure alarm indicates a problem with one of the lottery game terminals. The display shows which terminal and what kind of alarm. A local failure identifies problems within the lottery agent terminal. Two local failures are further identified by alarm LEDs 106: 1) paper low; and 2) battery low.

All of the local alarms are also identified or defined on display 104. A paper low alarm tells the agent to change the printer paper. A battery low alarm indicates the back-up battery is not functional to prevent loss of memory contents in the event of a power outage.

The lottery game terminal link to the agent terminal is a half duplex, serial, RFI (radio frequency interference) shielded communications line. The link is completely isolated and protected from all other agent terminal circuitry and is connected to agent terminal control system 92 through this isolation circuitry and via system data bus 98.

110 An autodialer 108 converts telephone numbers supplied by control system 92 over system data bus 98 to dial pulses. The dial pulses control the on/off hook state of a modem 106. Modem 106 converts dial pulses from autodialer 108 to on/off hook states. Modem 106 also converts data from control system 92, supplied over system data bus 98, to a standard FSK (frequency shift keying) tone; data from the telephone line is converted to data read by control system 92 as supplied over system data bus 98 by modem 106. Modem 106 meets FCC rules, Part 68 and may be of the type manufactured by RACAL-VADIC Corp. of California.

A schematic diagram of central processing unit circuitry used in a lottery agent terminal is shown in Fig. 6. Table 1 is included to identify the various

130

College	Tuition and Fees	Admissions	Deadlines	Audition	Website
Boston University  One Sherborn Street Boston, MA  -School of Theater-	Per Year: \$ 34,930  Fees Around \$ 2,532	SAT or ACT (with Writing Test) Two SAT Subject Tests (recommended) The scores of required tests (see Standardized Testing below), essays, teacher and counselor recommendations, and other personal qualifications as demonstrated by extracurricular activities are also carefully evaluated and weighed before decisions to offer admission are made.	Jan 1 <sup>st</sup> : applications Feb 15 <sup>th</sup> : Deadline for the CSS/Financial Aid PROFILE and Free Application for Federal Student Aid (FAFSA) May 1 <sup>st</sup> : deadline for response of admission/aid.	Prepare two, two minute monologues: one classical (in verse), one contemporary. Bring a picture and resume to the audition. Union Square Hilton, San Francisco.	<a href="http://www.bu.edu/cfa/">www.bu.edu/cfa/</a>  <a href="http://www.bu.edu/">www.bu.edu/</a>
Emerson  120 Boylston Street Boston, MA	Per year: \$26,880  App. Fee: \$65	• Common Application, including the Required Supplement • \$65 application fee • School Report with official high school transcript • Mid Year Report • Teacher Evaluation • Official SAT or ACT test results (or both) • Final Report (to be submitted at the conclusion of your senior year of high school)	Jan 5 <sup>th</sup> : Application due (Notification Date: April 1) March 1 <sup>st</sup> : Financial aid application due	Submit a resume of all theater related activities. San Francisco  • Friday, February 8, 2008 • Saturday, February 9, 2008  You will be able to schedule an audition and upload your résumé using Stagedoor once you have received your Emerson ID and PIN.	<a href="http://www.emerson.edu/">www.emerson.edu/</a>  <a href="http://stagedoor.emerson.edu/public/index.cfm?id=acting">http://stagedoor.emerson.edu/public/index.cfm?id=acting</a>
Columbia College Chicago					

College	Tuition and Fees	Admissions	Deadlines	Audition	Website
Cornish College of the Arts Seattle, WA	Tuition Per Year: \$22,350 Theater Lab fees: \$175 Comprehensive Fee: \$300 App. Fee: \$35	Students are scheduled for auditions or portfolio reviews after Part-One of their Application for Admission is complete. Part-One consists of the Application itself, essays and transcripts Must have above a 2.0 GPA.	--Two monologues from Contemporary plays. Cornish will provide you with one of the monologues. The other monologue is of your choice. --Prepare 16 bars of a song (a verse and a chorus) to be sung unaccompanied--choose a song that allows you to play an action, and brings your focus out rather than inward. --bring copy of your resume and a picture to the audition. --interview after audition. --audition in SF--TBA	Students can apply at any time during the year and admission decisions are mailed on a rolling basis approximately three weeks after the completion of your audition. March 1 <sup>st</sup> : Part One of the Application for Admission – the Application, essays and transcripts Part Two of the Application for Admission – the audition or portfolio review The FAFSA – should be submitted to the processing agency absolutely no later than this date and preferably by February 15.	<a href="http://www.cornish.edu/default.php">http://www.cornish.edu/default.php</a>
University of Illinois—Chicago EPASW Bldg. 1040 W. Harrison St. MC-255 Chicago, IL	Tuition and fees: Illinois residents pay from \$4,142 to \$6,149* per semester Non-Illinois residents pay from \$9,765 to \$12,344* per semester App. Fee: \$40	-online application -send in transcript and test scores. --have a min. of a 3.5 GPA --audition	<a href="http://www.uic.edu/depts/adpa/theaterpages/theater-auditions.htm">http://www.uic.edu/depts/adpa/theaterpages/theater-auditions.htm</a> -to schedule an audition/interview; call Neal McCollam at (312) 996-3991.	Jan. 15 <sup>th</sup> : application due	<a href="http://www.uic.edu/index.html">http://www.uic.edu/index.html</a> <a href="http://www.uic.edu/depts/oar/undergrad/apply_undergrad.html">www.uic.edu/depts/oar/undergrad/apply_undergrad.html</a>
DePaul 2135 and 2130 N. Kenmore Ave., Chicago, IL	App fee online: \$25/ \$40 on paper	-SAT scores (college code SAT is 1165.) -Transcript --send in a picture 1. Submit three recommendations 2. Send \$25.00 audition fee 3. Schedule an audition	Feb 10 <sup>th</sup> and 11 <sup>th</sup> —Audition at 8 am @ San Francisco Hilton Feb 10 <sup>th</sup> and 11 <sup>th</sup> —Audition at 1 pm @ San Francisco Hilton	Jan 15th: applications are due (notification in late March) May 1 <sup>st</sup> : response deadline Feb 15 <sup>th</sup> : FAFSA	<a href="http://theatreschool.depaul.edu/undergraduate_admissions.php">http://theatreschool.depaul.edu/undergraduate_admissions.php</a>
College	Tuition and Fees	Admissions	Deadlines	Audition	Website

University of Arts— Philedelphia PA	
Full-time undergraduate \$27,220	



integrated circuits shown in Figs. 6—9 according to industry standard parts numbers. Fig. 6A provides a tamper sensor circuit U8—14; a power supply U9; a back up battery BT1 and low battery detector circuit U8—2; and a reset circuit U7.

TABLE 1  
Integrated Circuit Identification

Identifier	Figure	Industry part no.
10 U6	6A	4093
U7		4584
U8		LM3302
U9		LM323
U3	6B	LS74
15 U4		S74
U5		S04
U14		8031
U15		LS24
U16		LS30
20 U17		LS04
U21/U22		2764
U24		GN139
U28		LS373
U29/U30/U32		LS244
25 U31		LS245
U5	6C	S04
U10		LS74
U11		LS32
U12		8294
30 U13		146818
U17		LS04
U18		LS32
U19		LS138
U20		LS139
35 U23		6116
U25		LS30
U26/U27		LS244

TABLE 1 (contd.)  
Integrated Circuit Identification

Identifier	Figure	Industry part no.
70 U9/U10/U20/U21/ U32/U33/U34/U45 U11	7A	LS138 LM323
75 U22		LS139
U23		4093
U35		LM3302
U42/U43		LS244
U44		LS245
80 U46		LS00
U47		S74
U1—U8/U12—U19/ U24—U31/U36—U41	7B	7C5516APL
U7	8A	LM323
85 U9		74LS139
U11/U13/U19/U20		74LS244
U16		74LS00
U17		74LS32
U21		74LS245
90 U22		74LS74
U23		4069
U1/U3/U6	8B	7407
U4		74LS245
U8/U9		74LS139
95 U10		74LS374
U14		74LS123
U18		74LS32
U20		74LS244
U22		74LS74
100 U1/U2	9	GN139
U3		LM309K

Fig. 4 is a schematic diagram of a lottery game terminal interface module. The diagram shows a plurality of latches that are addressable according to a decoded memory address present at decoder U2. When addressed, each latch produces an output signal indicative of a signal condition at the latches

input. Accordingly, optoisolated output signals are provided to operate various lottery game terminal features. Some such operation is the result of address and data information provided by the microprocessor module. Other such control is a function of combinational logic in the interface module itself. The interface module also provides a data bus which couples the microprocessor module to the tone generator module.

Fig. 5 is a schematic diagram of an exemplary tone generator module. Data from the interface module is coupled to the tone generator module by means of optoisolators U12—U18. A sound generator circuit U7—U10 produces tones in accordance with data supplied from the interface module and under the control of a central processing unit U23. The CPU operates the sound generator circuit to generate these tones in accordance with tone program instructions stored in EPROM U22. Signals output from tone generator U7—U10 are mixed at a summing amplifier U6—U7, filtered by low pass filter U6—1, and amplified for reproduction by speaker at a cabinet mounted amplifier U3—4. Various switches S1 are included that may be set to preprogram certain sound effects.

Fig. 6B is a schematic diagram showing microprocessor U14. The microprocessor controls all operation of the agent terminal. Various signals generated by the support circuits shown in Fig. 6A are coupled directly to the microprocessor to provide game operation interrupts in the event of extraordinary events, such as low power or tampering. Fig. 6B also shows data and address bus buffering and latches U28—32. Microprocessor clock circuit U4—U5 provides a clock input signal for driving microprocessor U14. Agent terminal program instructions are stored in EPROM memory U21—U22. A program listing of the EPROM contents is included as part of the microfiche appendix accompanying this application.

Fig. 6C is a schematic diagram showing various control circuitry devices coupled to microprocessor U14 via the data and address buses. A scratch pad memory U23 is included as a work space for the microprocessor in which the microprocessor may make calculations and store short term information. Real time clock 102 is shown consisting of a clock circuit U13 and clock control crystal Y2. Data encryption circuit 103 is shown consisting of a data encryption device U12 which may be of a type commonly known and readily available commercially. Telephone line interfacing is controlled by modem interface circuit U26 as operated by modem control circuit U10/U20 in response to control signals from microprocessor U14.

A variety of circuit options may be included by setting the combination of switches at dual in-line pin (DIP) switch assembly S1. The switch setting is coupled to the data bus by a buffer circuit U27 and, when scanned by microprocessor U14, produces a unique data word that may correspond to any programmed sequence of instructions contained in EPROM circuit U21/U22. In this way, customized features may be added to the agent terminal, such

as selectable polling intervals, agent location payout amount authorization (changing the value of a high tier win).

A schematic diagram of CMOS memory module 101, used in a lottery agent terminal, is provided by Fig. 7. Fig. 7A shows memory address decoders U42/U43, a power down detect circuit U35, a reset circuit U23/U46, a regulator and battery backup circuit U11/U35—2, and a secure memory consisting of memory circuits U9/U10/U20/U21/U32/U34/U35. Fig. 7B is data memory 101 and comprises integrated circuit memory U1—U8/U12—19/U24—U31/U36—U41.

A schematic diagram of an interface circuit used in the lottery agent terminal is shown in Fig. 8. Fig. 8A includes data bus buffering circuitry for interfacing a printer U13 and a keyboard U11. Circuitry is also provided for regulating various voltages supplied throughout the agent terminal. Fig. 8B provides buffering in interface circuitry for a 20 character line at a time display U4, additional keyboard strobing circuitry U8, printer control and interface circuitry U12, and keyboard contact strobe circuitry U10. Additionally, a regulator circuit U14 is included for providing regulated voltages to various points in the agent terminal.

A schematic diagram of a power and game terminal interface circuit used in the lottery agent terminal is shown in Fig. 9. Fig. 9A shows an optoelectric coupler U1/U2 for coupling the agent terminal serial port to a plurality of parallel connected lottery game terminals. Fig. 9C shows an agent terminal power supply circuit.

Video lottery system operation is as follows: In a standby mode, lottery agent terminal software polls each associated lottery game terminal. The software reads the game terminal meters and stores the data in the data memory. Old meter readings are overwritten by the most recent meter readings.

From the lottery agent terminal, any one or all lottery game terminals at any site may be started or stopped. Starting a lottery game terminal initiates the attract mode, allowing normal play. Stopping a lottery game terminal allows a game in progress to continue to completion. No coins are accepted and no credits can be played thereafter. When the game in play is completed, a winning ticket is automatically issued for any remaining accumulated winnings.

To print a winnings ticket, a player presses a "collect winnings" button on the lottery game terminal. During game terminal polling, the agent terminal detects the collect winnings request and the amount of the win. The agent terminal replies with a ticket number, time stamp, and validation number, which the game terminal uses to print the winning ticket. The player may redeem the ticket the same business day, in which case the ticket number is entered into the lottery agent terminal from keyboard 94 by the agent, including a time stamp, validation number, and winning amount. The agent pays validated low tier wins and indicates payment has been made with the agent terminal keyboard. Low tier winnings that are not collected the same

day at the location of the win can be collected by processing a claim from a lottery claim office.

A high tier winner or accumulation of low tier winnings over \$599 in the present embodiment of the invention causes an automatic generation of request for a winning ticket. During lottery agent terminal polling, the agent terminal detects the request of a high tier collect winnings, dials the central computer system, and sends the win information to the central computer system. The central computer system replies with a validation code, which the agent terminal sends, along with the ticket number and a time stamp, to the lottery game terminal at which the win occurred. The game terminal prints a winning ticket that the player must redeem by sending a claim form to the lottery headquarters. Validation is supplied from the central site computer system through a validation terminal at the lottery headquarters.

At the end of each business day, the central computer system dials each lottery agent terminal. The lottery agent terminal responds by encrypting and transmitting all of the day's transactions as recorded in its meters. The central computer system can request further back up information as required.

If at any time lottery agent terminal data memory 101 is too full, there is a danger of overwriting information not yet transmitted to the central computer system. To prevent this from occurring, the agent terminal dials the central computer system and requests data transmission.

At the end of each business day, each lottery agent terminal prints a hard copy summary of cash, alarms, and unclaimed ticket transactions. This information is available as a subtotal on display 104 at the agent's request.

There are four basic types of alarms used in the exemplary embodiment of the present invention. These four alarms, plus two local advisory alarms, comprise alarm LEDs 106 located on the agent terminal front panel, as discussed above. Display 104 provides a further definition of LED indicated alarms. All alarms are reported to the central computer system.

A red LED indicates failure in one or more of the lottery game terminals. Display 104 indicates the lottery game terminal number and the type of failure. Another red LED indicates a failure in the central computer system or in the communications link to it. Display 104 indicates the nature of this failure. A further red LED indicates a failure within the lottery agent terminal. This failure is defined by display 104 and by two other LEDs, that indicate paper low and battery low. If the data memory battery is about to fail, the agent terminal also dials up the computer system and requests permission to transmit all of its data.

The lottery agent terminal constantly tests and verifies operation of associated hardware and software. Any errors encountered are reported as an LED alarm, and also as a message on display 104. Specific test software is available to the maintenance person from keyboard 94 under control of security lock 96. Such software is listed as

part of the microfiche appendix included with this patent application.

System saturation is at the point where any given line is overloaded by incoming traffic. Because the present invention is a dial-up system, the traffic demands upon it are greatly reduced. During off hours, all units are interrogated to gather data base information. This arrangement does not preclude interrogation at any other portion of a 24 hour day. During a typical day of operation, computer communication traffic to the central computer system is low, comprised only of high tier wins and reported malfunctions. The computer system described in the present invention is of a size to preclude any throughput problems. The lottery agent terminal may operate up to 64 lottery game terminals, far in excess of the number generally included in any lottery location. System saturation from a communications point of view is also avoided with a large margin of reserve capacity. For purposes of an exemplary system saturation analysis, the following assumptions may be made:

1) Two lottery game terminals to lottery agent terminal; 5,000 agent lottery terminals supporting 10,000 lottery game terminals;

2) 4 hour data polling time; 3) 300 baud communications rate; and 4) 2 minute hook up time from the central computer system to the agent terminal.

Although the worse case hook up time is 120 seconds, the average time is much less. The difference between average and worse case in the exemplary embodiment of the present invention is here used for data failure retransmission.

Each game's data consist of 2,000 bytes. Using an assumed average of ten lottery game terminals per agent terminal providing 5,000 agent terminals supporting a full complement of 10,000 games, the following analysis applies:

$2,000 \times 1/300 \text{ baud} \times 10 \text{ bit/byte} \times 2 (\text{games} + 120 \text{ second hook up time}) = 133.33 \text{ seconds transaction time} + 120 \text{ seconds} = 253.33 \text{ seconds computer to agent terminal time}$

Using 253.33 secs  $\times$  5,000 agent terminals over 3,600 seconds/hour = 261.47 modem hours.

Using 4 hours polling time, the number of modems is equal to  $351.8/4 = 87$  modems per 4 hour polling cycle. The above analysis indicates that by increasing the number of lottery game terminals per lottery agent terminal, or by increasing the number of modems, the system can be increased well beyond that described herein for the exemplary embodiment of the invention.

Fig. 10 is a flow diagram showing an exemplary state lottery incorporating one embodiment of the present video lottery system. Game play begins when a player deposits a coin (200) into a lottery game terminal. The coin is held in escrow (201) until after the game play has been completed for a particular game sequence. Upon completion of the game, the coin is dropped into the coin box (203).

If the player wins (202), a determination is made as to whether the win is a low tier win (205) or a high tier win (207). For a low tier win, a payout is made by the agent at the agent location (206). Low tier

winning tickets at the agent location are periodically collated (210) and forwarded to the central computer site for accounting purposes (214).

If there is a high tier win, a claim form is prepared by the agent at the agent location (208). Winnings are collected by presenting the claims form to the lottery commission (222). Information relating to the high tier payout is forwarded to the central computer site for accounting purposes (214).

Each lottery game terminal stores metered data providing an audit trail of game operation (202). This information is monitored by polling of the lottery game terminals at the agent location by the agent terminal (204). Agent terminal information is in turn provided to the central computer and added to the central computer's data base (215).

System activity totals are directly reported to the lottery commission (220). Additionally, various reports are prepared by the central computer system (216) and forwarded to the lottery commission in the form of a hard copy print out (221).

Coins accumulated in the coin box at each lottery game terminal are periodically collected (209) and deposited (212) to a state bank account (213). Deposits to the state bank account are noted in the central computer data base (218). After collection, there is a reconciliation (211) between metered coin collection and actual coin collection. Resulting data are provided to the central computer data base for accounting purposes (214). A weekly reconciliation and winning ticket summary is produced by the central computer data base (217) and stored in an electronic file (219).

The foregoing was given for purposes of illustration and example of a preferred embodiment of the present invention. The invention may be provided in a variety of selected features in other embodiments equivalent to the one described herein. For example, a smaller or larger central site computer system may be provided as lottery system needs vary; various types of lottery game terminals may be provided featuring any one or several of the many popular lottery type games; and commercial hardware and software specified herein as being of a preferred type may be readily replaced by other similar commercial hardware and software as desired. Therefore, the scope of the invention should be limited only by the breadth of the claims.

#### CLAIMS

1. A video game system, comprising:  
a central computer for providing a game system data base; and  
a remotely located agent terminal, coupled for answer/originate communication with said central computer, for gathering, and for reporting to said central computer on demand, game system data corresponding to system game activity at said agent terminal location, and for immediately reporting extraordinary system game activity to said central computer.

2. The system of claim 1, further comprising at least one game terminal coupled for communication

with said agent terminal in response to agent terminal polling of said game terminal.

3. The system of claim 2, said central computer comprising a primary central processor for managing said game system data base and for controlling communications with said agent terminal.

4. The system of claim 3, said central computer further comprising at least one secondary central processor, coupled to said primary central processor for communication therewith, said secondary central processor being capable of managing said game system data base and controlling communications with said agent terminal in the event of a primary central processor failure.

5. The system of claim 1, wherein said agent terminal is coupled via telephone lines for communication with said central computer, said agent terminal and said central computer further comprising modem means for interfacing said agent terminal and said central computer to said telephone lines.

6. The system of claim 5, said modem means further comprising answer/originate means for automatically initiating an outgoing telephone call in response to agent terminal and central computer control and for automatically answering an incoming call.

7. The system of claim 5, further comprising means associated with said agent terminal and with said central computer, for encrypting all communications between said agent terminal and said central computer.

8. A video lottery system, comprising:  
a multiprocessor central computer including a primary central processor for managing a lottery system data base and for controlling central computer communications, and at least one secondary central processor, coupled to said primary central processor for communication therewith, said secondary central processor managing said lottery system data base and controlling central computer communications in the event of a primary central processor failure;

at least one remotely located agent terminal, coupled via telephone lines for answer/originate communication with said central computer, for concentrating lottery system data by gathering, and reporting on demand, lottery system activity at said agent terminal location and by immediately reporting extraordinary lottery system activity to said central computer on the occurrence thereof; and

at least one video lottery game terminal coupled for serial communication with said agent terminal, and providing a meter summary of lottery game terminal activity to said agent terminal in response to agent terminal polling thereof.

9. The system of claim 8, wherein said agent terminal and said central computer further comprise answer/originate modem means for interfacing said agent terminal and said central computer to said telephone lines, for automatically initiating an outgoing telephone call in response to agent

terminal and central computer control, and for automatically answering an incoming telephone call.

10. The system of claim 9, said central computer further comprising at least one computer terminal including a display and a keyboard.

11. The system of claim 10, said central computer further comprising memory means for storing said lottery system data base.

12. The system of claim 11, said memory means comprising a disc memory device.

13. The system of claim 11, said memory means comprising a tape storage device.

14. The system of claim 11, said central computer further comprising a printer.

15. The system of claim 8, further comprising encryption means, associated with said central computer, said agent terminal, and said lottery game terminal, for encrypting all communications therebetween.

16. A video lottery system, comprising:  
a central site computer system, including:  
a) a primary central processor having associated therewith a display/keyboard and a data storage memory, said primary central processor providing a lottery system data base and controlling central computer communications;

b) a secondary central processor, having associated therewith a display/keyboard and a data storage memory, said secondary central processor coupled for communication with said primary central processor and being capable of managing said lottery system data base and controlling central computer communications in the event of a primary central processor failure; and

c) a management central processor, having associated therewith a display/keyboard and a data storage memory, for alternately supervising said lottery system data base and for managing said lottery system data base and controlling central computer communications in the event of a primary central processor failure;

a plurality of remotely located agent terminals, coupled for two way answer/originate communication with said central computer, for gathering, and for reporting on demand in response to central computer polling thereof, lottery system data corresponding lottery system activity at said agent terminal location, and for immediately reporting extraordinary lottery system activity at said agent terminal location to said central computer;

a multiplexed communications interface at said central computer including a plurality of answer/originate modem means for interfacing said central computer to a plurality of central computer site telephone lines;

modem means, associated with said agent terminal, for interfacing said agent terminal to central computer site telephone lines, said modem means capable of automatically initiating outgoing telephone calls in response to agent terminal control and capable of automatically answering an incoming telephone call from said central computer; and

a plurality of video lottery game terminals associated with each agent terminal and coupled for communication with said agent terminal to provide metered lottery game terminal activity summaries to said agent terminal in response to agent terminal polling thereof.

17. The system of claim 16, said primary central processor further comprising:

a central processor interconnecting bus;

a minicomputer central processing unit coupled to said bus;

a random access memory, coupled to said bus for storing and retrieving data in response to minicomputer control;

a data storage disc memory and disc controller, coupled to said bus, for storing and retrieving data and for retrieving system program instructions in response to minicomputer control;

an interprocessor linking means, coupled between said primary central processor, and said secondary central processor and management central processors, for providing network communications between said primary central processor and said secondary and management central processors; and

a communications port means, coupled to said bus, for providing two-way communication under minicomputer control between said primary central processor and said communications interface.

18. The system of claim 16, said lottery system data base further comprising:  
means for controlling central computer communications;

means for encrypting and decrypting data exchanged between said central computer and said agent terminal;  
means for establishing communication links between said primary, secondary, and management central processors;

means for maintaining data base files;  
means for generating data base reports;  
means for maintaining central computer network files;  
accounting means for processing polled data; and  
means for archiving system data to said data storage memory.

19. The system of claim 16, said agent terminal further comprising:

an agent terminal interconnecting bus;

an agent terminal control system coupled to said bus, for controlling agent terminal operation;

an agent terminal communications module including an autodial modem for responding to and establishing a communications link via telephone lines with said central computer, said communications module responsive to commands from said control system coupled thereto by said bus;

an input module, coupled to said control system via said bus, for coupling agent terminal associated events and agent terminal input data to said agent terminal;

an output module, coupled to said bus, for operating agent terminal associated data and information reporting devices; and

- a support module, coupled to said bus, for providing control system support including data memory storage, data encryption/decryption, and a real time clock.
- 5 20. In an electronic lottery system, a method for concentrating lottery game terminal metered activity data and for communicating said data from a plurality of said lottery game terminals to a central computer system, comprising the steps of:
- 10 metering game activity at each of said lottery game terminals;  
continuously polling each of said lottery game terminals and agent terminal to collect metered data;
- 15 periodically polling said agent terminal with said central computer to collect said lottery game terminal data;  
immediately reporting extraordinary lottery game terminal events to said central computer with said
- 20 agent terminal; and
- supervising lottery game terminal operation with said agent terminal to permit and inhibit lottery game terminal operation.
21. The method of claim 20, further comprising:
- 25 receiving winning information from a lottery game terminal at said agent terminal;  
generating and transmitting a validation code from said agent terminal to said winning lottery game terminal; and
- 30 transmitting permission to print a winning ticket to said winning lottery game terminal.
22. The method of claim 21, further comprising the step of comparing said validation code printed on said winning ticket by said winning lottery game
- 35 with the validation code generated by said agent terminal and displayed thereon.
23. A game system substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.